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DEPARTMENTS

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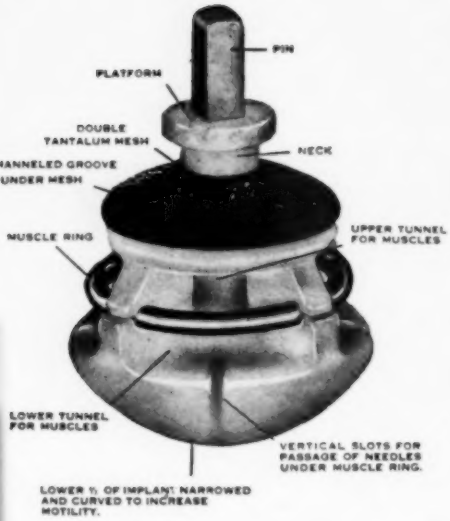

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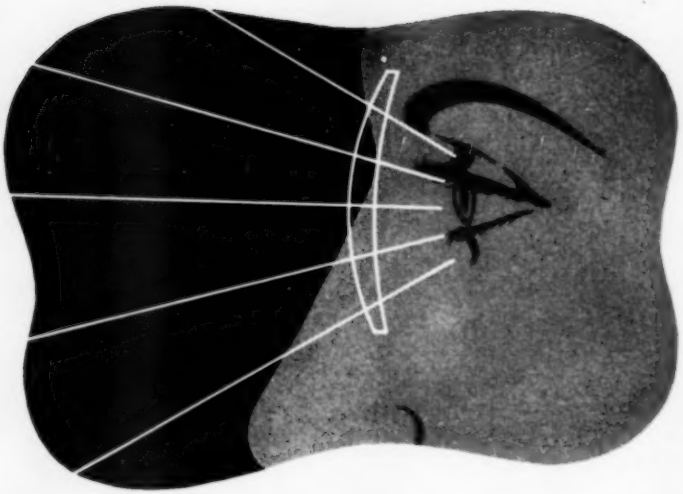

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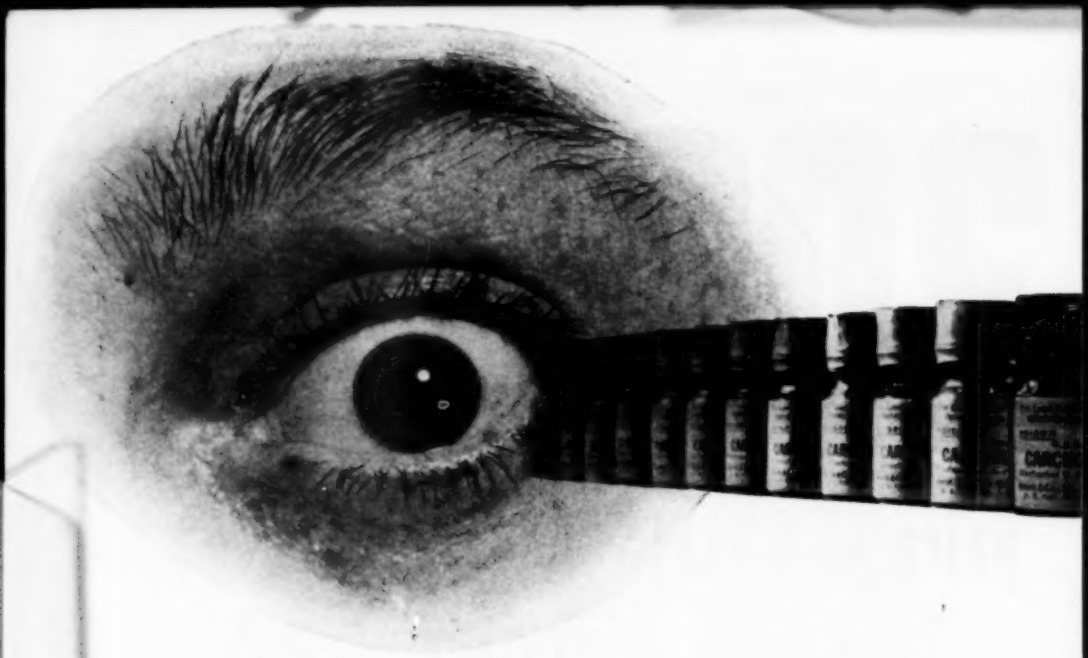

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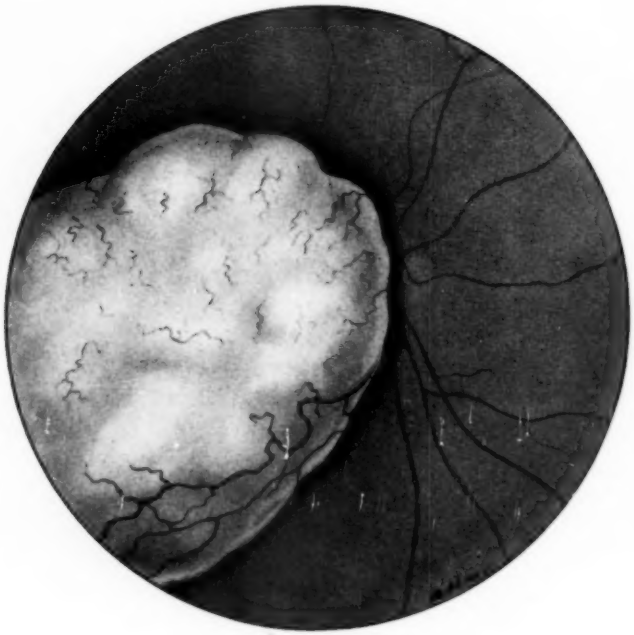

FIG. 1. FUNDUS DRAWING OF THE LEFT EYE OF CASE 13 BEFORE TREATMENT. (SEE PAGE 179).

FIG. 2. FUNDUS DRAWING OF THE LEFT EYE OF CASE 13 FOUR AND ONE-HALF YEARS AFTER COMPLETION OF IRRADIATION. (SEE PAGE 179).

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 32 FEBRUARY, 1949 NUMBER 2

TREATMENT OF BILATERAL RETINOBLASTOMA BY IRRADIATION AND SURGERY*

REPORT ON 15-YEAR RESULTS

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New York

This combined method of treatment for bilateral retinoblastoma was instituted in 1933 by two of us (H. M. and A. B. R.). The principles of the approach to this problem were: first, the surgical removal of the eye with the more advanced lesion, and, second, the treatment by fractionated roentgen irradiation of the remaining eye in an attempt to conserve vision.

The object of the X-ray therapy is to direct a lethal dose of roentgen rays to the site of the lesion in the posterior sector of the globe to the exclusion of the anterior sector. The anterior part of the eye, including the cornea, iris, ciliary body, and lens, is vulnerable to roentgen rays, while the posterior sector of the eye tolerates it well. If a small fraction of the dose given by the method described here were given without proper direction of the beam, the eyeball would be lost invariably.

In 1936, the technique was described,[1] with reports on the progress up to that date in the cases of 6 patients, all of whom had then been observed for less than five years. In 1942, a second report[2] was published giving the follow-up observations in the previously recorded cases, adding 4 new cases and describing modifications in technique. In 1945, a third report[3] presented follow-up data on all the cases previously reported, with the results to date in 14 additional patients—a total of 24 cases of bilateral retinoblastoma treated by this combination of surgery and irradiation.

The purpose of the present communication is to present follow-up data in the cases previously reported, to record the results to date in 31 additional cases, and to comment on various phases of the method of treatment which now covers a 15-year period.

END RESULTS TO DATE IN 55 CASES OF BILATERAL RETINOBLASTOMA TREATED BY THIS METHOD

In reporting end results in the treatment of cancer a 5-year period of observation is generally accepted as being necessary before reliable conclusions can be drawn. Furthermore, it is generally recognized that the number of patients surviving after additional 5-year periods will be appreciably less than after the first 5-year interval. Therefore, the cases have been separated into the appropriate intervals for comparison.

All cases that have applied for treatment have been accepted, no matter how unfavor-

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§ Attending Surgeon, Memorial Hospital for the Treatment of Cancer and Allied Diseases.

able the prognosis. Naturally, the smaller the lesion in the eye to be irradiated the better the chance of success. Experience has shown, however, that very occasionally an advanced case will respond well to therapy, but this is an exception that scarcely alters the general rule.

eighth year of rhabdomyosarcoma of the temporal muscle invading the orbit. This second neoplasm arose at the site of the temporal portal and undoubtedly was secondary to radiation. After necropsy, the microscopic examination of the irradiated eye showed that the retinoblastoma was com-

TABLE 1

END RESULTS, BY 5-YEAR INTERVALS, OF 55 CASES OF BILATERAL RETINOBLASTOMA TREATED BY THIS METHOD PRIOR TO MAY, 1948

TOTAL NUMBER OF CASES		55
Lost to follow-up	1	
*Number of patients excluded from series for statistical purposes	2	
TOTAL NUMBER OF PATIENTS FOR STATISTICAL PURPOSES		53
Total number of patients surviving less than 5 years	29	
Total number of 5-year survivals	9	
Total number of 10-year survivals	2	
Total number of 15-year survivals	1	
TOTAL NUMBER OF PATIENTS SURVIVING WITHOUT RECURRENCE		41 (77.4%)
Total number of patients surviving without recurrence and with vision		25 (47.2%)
a. Less than 5 years	19	
b. 5 years	5	
c. 10 years	0	
d. 15 years	1	
FAILURES		
1. Death due to retinoblastoma		12 (22.6%)
2. Patients living but requiring enucleation after treatment due to recurrent disease		6
a. Surviving less than 5 years	4	
b. Surviving 5 years	2	
3. Patients living but requiring enucleation after treatment due to secondary glaucoma		4
a. Surviving less than 5 years	3	
b. Surviving 5 years	1	
4. Total number of patients surviving without recurrence but blind		16
a. Less than 5 years	10	
b. 5 years	4	
c. 10 years	2	
5. Total treatment failures		38
DEATHS DUE TO OTHER CAUSES		1
FIVE TO FIFTEEN-YEAR END RESULTS		
Total number of patients		19
Total number of patients living without recurrence and with vision		6 (31.6%)
Total number of patients living without recurrence but blind		6 (31.6%)
Total number of patients living without recurrence		12 (63.2%)
Deaths due to retinoblastoma		7 (36.8%)

* Cases 2 and 18. (See explanation in text, pages 176 and 177.)

During the past 15 years, 55 patients with bilateral retinoblastoma have been treated by the combined method of surgery and irradiation. This survey covers the period from February 16, 1933, the time when the first X-ray therapy was given, to May 15, 1948. Three of these cases require special explanation:

Case 2 showed complete regression of the tumor, and the child had good vision for seven years after treatment but died in the

pletely arrested. In the previous report,[3] this case was eliminated from statistical consideration and, although we feel that this can justifiably be considered a 5-year cure with vision, the same disposition will be maintained.

Case 4 is another unusual situation. This child showed no evidence of disease for 6 years and three months following X-ray therapy and then developed a mass in the right antrum. A biopsy was inconclusive,

there being considerable doubt concerning its exact nature, although retinoblastoma could not, with complete certainty, be excluded. This case is listed among the failures—death due to retinoblastoma—even though it could equally well have been listed as death due to radiation sarcoma.

Case 18 was followed for 2 years and 8 months but has since been lost to follow-up. This case is therefore excluded for statistical purposes.

Failures

The failures have been divided into four categories: 1. *Deaths due to retinoblastoma,* of which there were 12, or 22.6 percent, in the entire series. Eleven of the 12 deaths occurred within five years after the completion of therapy. The 12th death was Case 4 which has just been explained. The earliest death came 2 months after treatment and the latest, excluding Case 4, came 4 years and 9 months after treatment. Therefore, we feel that a 5-year survival offers a good prognosis.

2. *Those patients in whom irradiation failed to control* the disease necessitating subsequent enucleation. There were 6 such cases, or 11.3 percent. All of the patients are alive at the present time and two are in the 5-year survival group. Of these two it can be said that, although the radiation failed in its purpose, it did not jeopardize the survival.

3. *Those patients who have subsequently required enucleation* due to complications of the treatment, all due to secondary glaucoma. These are not failures as far as survival is concerned but, since the purpose of the treatment is to retain the eye with useful vision, they must be classified as unsuccessful. There were 4 such patients, or 7.5 percent, one of whom is a 5-year survival.

4. *Those patients surviving without recurrence but with no useful vision.* Although the disease was arrested and the eye retained, the vision was lost, thus constituting a failure. There were 16 such cases, or 30.2 percent, of whom 6 have survived 5 years or longer.

The total failures are therefore 38, or 71.7 percent.

Statistical summary

The figures for the entire series, and for those surviving five years or longer, are given in Table 1 and are self explanatory. The criterion for vision has been set as 20/200 or better. In evaluating the figures in Table 1, particularly as regards vision, several modifying factors should be appreciated: first, during the first few years of this project one of the portals was, in most instances, directly over the eye, the beam passing through the anterior segment. Retinoblastoma is a fairly radio-sensitive tumor, but a dose of radiation lethal to the neoplasm invariably destroys the eye if it passes through the anterior segment. Second, many of the tumors have been situated in or about the macula thus immediately reducing the available vision. It is of interest that the tumor in the case of our one 15-year survivor was located in the macula but the patient now has 20/40 vision and attends public school.

The average mortality in cases of bilateral retinoblastoma, treated by enucleation only, is about 50 percent. In our series, considering only the 5-year survivals, the mortality rate is 36.8 percent, indicating that the combined method of treatment does not decrease the chances of survival.

The difference between the total number of survivors (41) and those surviving five years or more (16) is striking and indicates the growth of this project. The number of patients treated during the three 5-year periods included in this report is as follows:

First 5 years	7
Second 5 years	12
Third 5 years	36
Total	55

Observations on retinoblastoma

Retinoblastoma is presumably always a congenital tumor. The isolated cases reported as occurring in the second decade or in adult life probably represent slowly growing tumors which were, for some unknown reason, stimulated to increased activity and manifested themselves by an increase in size. Collected statistics on reported cases indicate that retinoblastoma is bilateral in 20 to 25 percent of cases. Our figures, however, show the lesion to be bilateral in 75 percent but this is unquestionably high because of our interest in treating this type of case. Our impression is, however, that the incidence of 25 percent is too low.

In cases of bilateral retinoblastoma, the tumor in the fellow eye should be demonstrable by careful examination at the time the lesion is recognized in the first eye. The lesion in the first eye is rarely recognized until it has reached an advanced stage, when the growth has sufficiently filled the vitreous cavity to give a white reflex through the pupillary area. If the fellow eye is involved, the tumor is usually small and in a radiation-curable stage.

It has been amply demonstrated that the involvement of the two eyes is not due to extension from one to the other but is the result of a multiple and independent origin of the growths. The growth in the less-affected eye may vary from a small, easily overlooked lesion to one, the extensiveness of which nearly equals that in the other eye. Fortunately, the former is more often the situation. When the growth in the fellow eye is small, near the equator or even more peripheral, it may easily be overlooked.

The examination should be made under as nearly ideal conditions as possible—general anesthesia, full dilatation of the pupil, the use of a speculum for retraction of the lids and of forceps for rotation of the eye. Frequent moistening of the cornea with normal saline may be necessary to insure the continued transparency of the cornea. Even after such precautions, we prefer, whenever possible, to repeat the examination after an interval of several weeks before declaring an eye free of disease. The assumption should be that the fellow eye is affected until it is conclusively proved otherwise.

The white reflex in the pupillary area was usually the first manifestation of the tumor. In several instances, however, a squint was the first manifestation and, rarely, an inequality of the pupils.

Supplementary observations on clinical course of retinoblastoma following radiation therapy

In the two preceding reports the intraocular changes and the complications following fractionated roentgen therapy in changes of retinoblastoma were described in considerable detail. This discussion will therefore only be summarized here and new observations added.

Significance of size and form of the tumor on prognosis

The smaller the growth, the more favorable is the case for treatment. Generally speaking, the most favorable cases are those with lesions occupying one quadrant or less of the fundus. However, as previously mentioned, we have been pleasantly surprised in an occasional case, with areas involving one half or more of the fundus, to see prompt and marked regression. One such case is now in the 5-year survival group. It should be emphasized however that this is the exception and probably is indicative of unusual radiosensitivity.

A flat, less elevated tumor offers a better prognosis than the raised, nodular variety extending forward into the vitreous. Usually, the thickness, or elevation, of the tumor is a greater handicap in treatment than the area covered by the base. Daughter areas in the vitreous generally indicate a poor prognosis, for they are usually associated with multiple lesions in the retina. If the

tumor reaches the choroid, it grows there with abandon in the rich vascular supply and, in our experience, is uncontrollable by radiation. As soon as this complication is recognized, the eye should be enucleated.

Signs of regression of the tumor

Probably the best index of regression is an increase in the calcium content of the tumor, as manifested by chalky white areas which gradually increase in size and finally coalesce to produce a single, nodular mass of calcium having the appearance of cottage cheese. Occasionally, however, a lesion can be seen to regress with very little calcium formation. The explanation of this is not apparent. The increase in calcium content accompanies the generalized shrinkage of the growth. The margins of the lesion become sharper and more distinct, and around the periphery there may develop a zone of chorioretinitic change in the form of atrophy, with or without proliferation of pigment. In rare cases, portions of the neoplasm may disappear completely leaving little or no visible trace.

Illustrative of the changes which occur as the lesion regresses are the photographs of fundus drawings made before treatment (fig. 1) and 4½ years after the completion of treatment (fig. 2). The changes are striking and represent one of our most satisfactory results. Not all cases manifest such marked shrinkage but this is the hoped-for result. The tumor, as seen, has been reduced to solid calcium and the surrounding retina shows moderate scarring and pigment proliferation. This patient, (T. W.) is now in the 5-year survival group. There is a stationary posterior cortical opacity in the pupillary area which reduces the vision to 20/70.

Complications

The several complications which occur in the treatment of retinoblastoma were fully described in our previous reports and should supplement this report.

Vascular changes. These are extremely important in as much as they constitute the most serious complication of the treatment, and may eventuate in loss of vision, secondary glaucoma, and atrophy of the globe. The late vascular changes, which appear 5 to 21 months after the completion of therapy, must be differentiated from those occurring toward the end of treatment and immediately thereafter.

The early reaction consists chiefly of retinal edema, which gives a grayish-white appearance to the retina. In one case, in which the tumor was located in the macula, this produced a typical "cherry-red spot." The edema gradually subsides after several months, but may leave the retina with a granular appearance. In addition to the edema, there may be small hemorrhages over and around the site of the lesion. None of these changes is an immediate threat to function, and can be considered a normal reaction to the therapy.

The late vascular changes, which appear on the average of 10 months after the completion of treatment, consist of retinal, preretinal, and vitreous hemorrhages. In the retina these may be located on and around the site of the lesion, or at distant sites, particularly around the disc. The source of these hemorrhages is the newly formed blood vessels in the retina which develop secondary to the radiation. These are thin-walled and tortuous, resembling the vessels in irradiated skin and there called telangiectasis.

A possible factor in their formation is the atresia of a portion of the normal, smaller veins and capillaries as a result of the irradiation, with consequent dilatation of the remaining vessels in order to provide for a collateral circulation. Telangiectatic blood vessels are always more fragile than normal vessels. Therefore, in the retina such vessels are probably easily ruptured when the local blood pressure rises with increased

pressure in the jugular venous area, where the veins have no valves. The jugular venous pressure, as well as the pressure in the intracranial and intraorbital regions, together with the pressure in the thorax, is raised with coughing, sneezing, and vomiting.

As a late sequela of these vascular changes, there may develop in the macular region around the fovea residual edema or multiple hard, white deposits similar to the lesions commonly seen in nephritis, diabetes, and the late stages of essential hypertension, and known as the "star of the macula." Two instances of the lesion have been noted in this series. In one case, in which the tumor was observed clinically and later examined microscopically, the macular deposits had an appearance and staining reaction similar to the macular lesions seen in the other vascular diseases mentioned above.

These late vascular changes may produce much more serious complications such as secondary glaucoma, retinitis proliferans, retinal detachment, and atrophy of the globe.

These late vascular changes were seen in 19 of the cases, or 34.5 percent. Five have had only one such extravasation, which has absorbed without complications. Eight have suffered recurrent hemorrhages, with accompanying vitreous opacities and varying degrees of retinal scarring. Six have never recovered from the initial massive hemorrhage, and the progression of events, already mentioned, has ensued, resulting in enucleation in 3 cases and atrophy in 2. The result in the sixth case is undetermined.

Although this complication may nullify the beneficial effects of therapy, the outlook, once hemorrhages appear, is not hopeless, for 11 patients, or 57.8 percent, have retained vision of 20/200 or better. Treatment with the newer drugs designed to decrease capillary permeability has been without benefit.

TABLE 2

GLAUCOMA AS A COMPLICATION OF RADIATION THERAPY

Case No.	Time of Onset Since First Treatment	Method of Treatment	Type of Operation	End Result
(1) Case 3	1 year, 3 months	Surgery	Trephining (2)	Phthisis
(2) Case 7	1 year, 1 month	Surgery	Trephining Complete iridectomy Iridotasis	Phthisis
(3) Case 19	6 years, 1 month	Miotics	None	Tension controlled as of 5-3-48; vision 20/100
(4) Case 21	2 years, 6 months	Surgery	Iridencleisis	Enucleation
(5) Case 24	1 year, 7 months	—	—	Enucleation
(6) Case 26	2 years	None	None	Atrophy
(7) Case 29	1 year, 3 months	Surgery	Iridencleisis	Phthisis
(8) Case 33	11 months	Surgery	Iridencleisis	Atrophy; enucleation
(9) Case 39	1 year, 3 months	Surgery	Iridencleisis	Tension normal; vision 20/200

In the early days of this work when these changes were first observed we interpreted them as indicating active growth of the tumor. This led us to give additional radiation and as a result the globes became atrophic. We now make it a rule not to exceed the specified dosage, as hereinafter described, for, as has been seen, many of these eyes clear spontaneously and follow a benign course, with neither recurrence nor further disturbance of function.

Glaucoma. Glaucoma occurs for several reasons: first, and most common, is hemorrhage, secondary to the late vascular changes which follow irradiation. Here again the matter of individual sensitivity seems of importance, for just as the degree of scarring

and telangiectasis of the skin varies widely among patients, so variation is seen in the retina. These vascular changes have already been discussed in more detail. Second, improper positioning of the portals, especially the nasal, with irradiation of the anterior segment, may produce iridocyclitis and secondary glaucoma. Third, continued growth of the tumor may give rise to glaucoma.

Glaucoma as a result of radiation, and not of continued growth of the tumor, was seen in 9, or 16.9 percent of 53 patients that have been treated. The time of onset, method of treatment, and the end result of these cases is shown in Table 2.

It is evident from Table 2 that the average time of onset of this complication is 1 year and 10 months following the beginning of treatment, or about 1 year and 7 months following the completion of the roentgen therapy. Only 2 of the 9 cases available to follow-up reacted favorably to treatment, while 7 have undergone atrophic changes, requiring enucleation in 3. The prognosis for either vision or control of the tension is unfavorable. This is probably accounted for by the fact that the late radiation changes are progressive.

Cataract. One of the most frequently mentioned complications of ocular radiation is cataract formation. In the early years of this work, the direct anterior portal inevitably produced cataracts. Special cones were designed to prevent this complication, but have not been completely successful.

Extreme care in the positioning of the portals must be exercised, for the difference of 1 or 2 millimeters in the direction of the beam can mean the difference between a clear or opaque lens. This is especially true of the nasal portal. The margin of safety with this portal is even less than with the temporal one, and the tendency is to angulate the cone less than 26 degrees. In this series 6 patients, or 11.3 percent, have developed radiation cataracts of which 5 have remained stationary. Table 3 lists these cases, the time of appearance of the opacity after irradiation was instituted, the type of treatment, if any, and the end result.

Consideration of Table 3 reveals that the average time of appearance of the cataracts was 3 years and 2 months. All began as posterior cortical opacities. In 3 patients, or 50 percent, it was felt that the lenticular opacity was the chief cause of the reduced vision. One patient has had the usual needling and linear extraction, followed by a discission, with a final vision of 10/50. The other 2 cases require no operative interference. The remaining 3 cases have, in addition to the lenticular opacities, retinal changes secondary to radiation which are the main factors in the reduced visual acuity. Thus it may be said that, although this is a complication to be avoided whenever possible, it is not a significant factor in the failure to maintain vision.

TABLE 3

RADIATION CATARACT AS A COMPLICATION OF THERAPY

Case No.	Time of Onset Since First Treatment	Treatment	End Result
(1) Case 1	5 years, 3 months	—	Stationary; vision 20/40
(2) Case 13	2 years, 9 months	—	Stationary since 1945; vision 20/70
(3) Case 17	3 years, 6 months	—	Stationary; vision 20/200
(4) Case 19	3 years, 10 months	—	Stationary; vision 20/200
(5) Case 23	1 year, 7 months	—	Stationary; vision 10/200
(6) Case 25	1 year, 11 months	Needling and linear extraction; discission	Progressive; vision 8/200 preoperatively; vision 10/50 postoperatively

Late skin changes. One of the inevitable results of intensive roentgen therapy is the damage done to the skin in the treatment areas. The initial erythema rapidly subsides

but other changes continue, and are progressive. The ultimate effect is seen 5 to 10 years after therapy and varies considerably with each individual. All of the patients show depigmentation, loss of substance, and scarring with telangiectasis of varying degrees.

Young, growing bone does not react favorably to X-ray treatment and its growth is frequently arrested. As the surrounding bone continues to develop, a hollowing of the temporal region and a saddle-nose deformity may appear. When severe, these changes may be quite disfiguring. Eight of our patients have manifested this osseous growth failure. The question of surgical correction of these defects naturally arises.

Irradiated tissue, due to its avascularity and loss of normal structure, does not heal well and grafts of any sort rarely survive. Plastic surgeons are understandably loath to attempt any procedures on these patients. One of our patients, against our advice, sought plastic correction elsewhere, and the end result is worse than the original appearance.

The parents are told of this complication before therapy is instituted, and most of them feel this is a small price if vision can be retained. Present-day cosmetics do much to hide these scars when the child becomes old enough to be conscious of them.

Nose bleeds. Since the beam of the nasal portal passes directly through the bridge of the nose, the mucous membrane in this region will undergo scarring and telangiectasia. These telangiectatic vessels are extremely fragile and may rupture spontaneously, from slight trauma, or from the irritation of an acute rhinitis. The resulting nose bleeds never assume alarming proportions and are, fortunately, rather infrequent. Only 9 of our patients have evidenced this complication and none has required any special treatment.

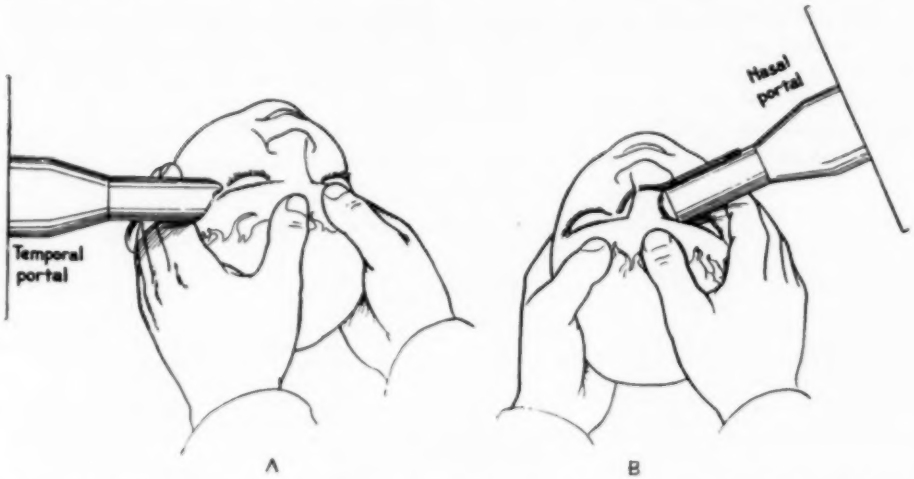

Fig. 3 (Reese, Merriam, and Martin). Roentgen irradiation of retinoblastoma. (A) The child's head is being held in position for irradiation of the posterior half of the left globe through a temporal portal. (B) The child's head is being held in position for irradiation of the posterior wall of the left globe through an oblique portal from the opposite side of the bridge of the nose.

Technique of fractionated radiation therapy of retinoblastoma

The details of the apparatus, irradiation factors, and the technique of application have been described in detail in the second[2]

and third[3] reports. These data will be briefly summarized again in the present report, and the method of application is illustrated in Figures 3, 5, and 6. The factors have been altered slightly during the past year due to a necessary change in X-ray equipment. However, the calculated tumor dose has remained essentially unchanged.

Any standard, high-voltage X-ray machine can be employed in this type of therapy, adhering as nearly as possible to the suggested half-value layer. We would strongly recommend employing the special cones, illustrated in Figure 4, since they provide more accurate directioning of the beam and eliminate scattering.

Time and experience have necessarily modified the technique as it was originally instituted. The anterior portal, placed directly over the involved eye and directed posteriorly through the anterior segment, has been eliminated. The use of this portal led to serious complications which usually ended in atrophy of the globe. With the proper use of only two portals, a cancericidal dose can be delivered to the tumor, sparing completely the anterior segment.

The total dosage has now become standardized at 8,000 r to each of the two portals. Undoubtedly, smaller doses might prove effective in an especially sensitive tumor, but no one is as yet able to ascertain these either clinically or microscopically. It is our feeling that it is wiser to employ the maximum dosage that the patient will tolerate and which has proven, in the majority of cases, to be lethal to the tumor. The dosages originally employed, although they were effective in eradicating the disease, were not tolerated by the eye.

There is, of course, a considerable variation in the manner in which these patients

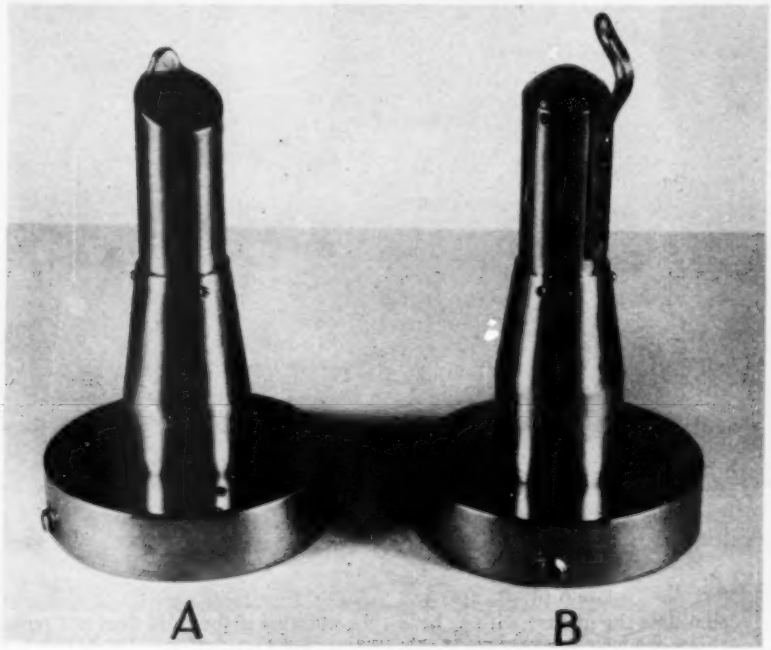

Fig. 4 (Reese, Merriam, and Martin). Special cylinders for radiation of retinoblastoma. (A) Temporal cone. (B) Nasal cone.

react to the therapy (individual sensitivity). In some there is a fairly wide margin between the cancericidal dose and that which the surrounding normal tissues will tolerate, but in others this margin is extremely narrow and even reversed. Fortunately, the latter are rare. It is the aim of any form of therapy to eliminate the disease with as little disturbance of function as possible, but in cancer therapy the patient's life is at stake and cosmetic and functional factors must be of secondary importance.

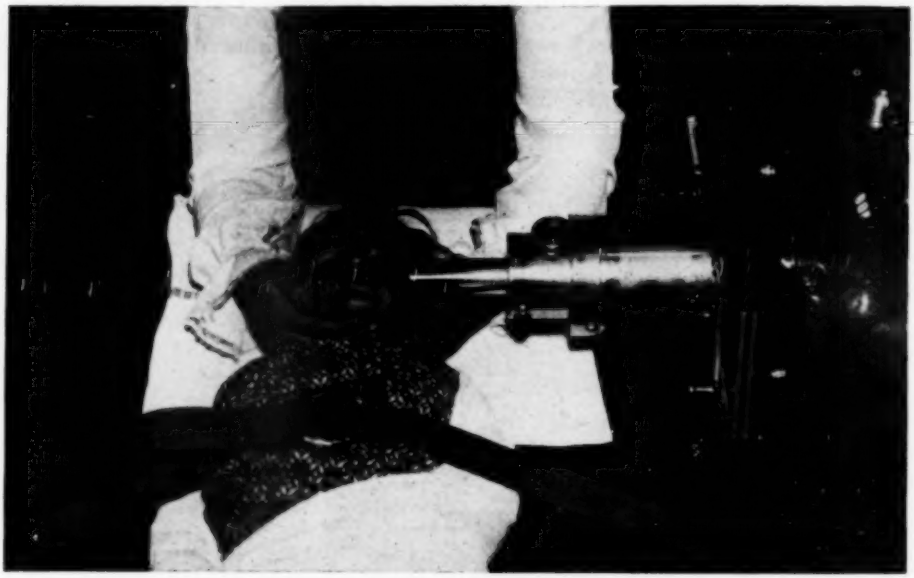

Fig. 5 (Reese, Merriam, and Martin). Irradiation of the left eye through temporal portal and immobilization of the patient.

Immobilization of the child during treatment

The holding of a crying, struggling baby under an X-ray machine (figs. 5 and 6) for 7 to 8 minutes three times a week over a period of 3½ months is an onerous undertaking. Such a task should, obviously, be the duty of the parents, or of other members of the family.

It is the responsibility of the therapeutist to see that the parents comprehend what they are to do and that they realize the importance of maintaining the head in an exact position, so that the beam will pass precisely through the posterior half of the globe and not through the anterior chamber. Accurate positioning of the portals can easily be nullified if the child does not remain quiet during the period of treatment.

The patient is mummified in the usual manner with a sheet, and immobilized by two straps, one across the chest and arms and the other across the knees. (figs. 5 and 6). We have found this satisfactory for even the small group of somewhat older patients. One of the parents, suitably protected by a lead apron, hold the head (figs. 5 and 6).

During the first few treatments frequent interruptions may be necessary to reposition the child and further instruct the parent but, after this period of adjustment, no further difficulty is encountered. In fact,

once acclimated, the older patients frequently require no restraint other than the reassurance of the parent's hands. Sedation has never been necessary. Lead gloves have not been used by the parents since they interfere with the task of holding the head. During the past 15 years, there has not been a single instance of radiation burn from scattering.

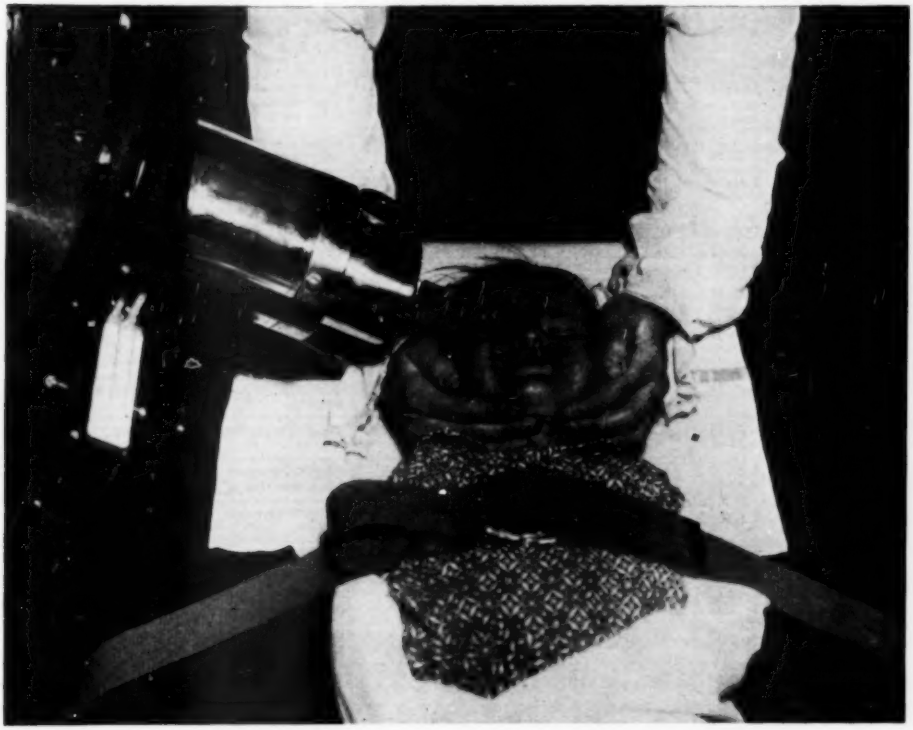

Fig. 6 (Reese, Merriam, and Martin). Irradiation of the left eye through the nasal portal and immobilization of the patient.

Frequency and duration of treatments

The treatments are given three times a week to alternate portals—400 r per treatment—for a total of 8,000 r × 2. Thus the treatment period lasts 3½ months. Many of these patients come considerable distances for treatment. Since hospitalization is not essential once the surgery, examination, and X-ray studies have been made, living facilities must be found. In the past few years this has constituted a very real problem. We have been fortunate in having the assistance of an unusually competent social-service department, which has solved this and other sociologic problems.

Treatment portals

The small size of the skin portals is one of the most important factors since it permits a total air, skin, and tumor dose considerably higher than that which larger portals would allow. The limit of accuracy in the direction of the beam of roentgen rays in these cases can hardly go further than to make certain that the radiation passes just posterior to the lens and ciliary body to the

TABLE 4

IRRADIATION TREATMENTS AND RESULTS IN 55 CASES

Case	Patient	Dates of Treatment	No. of Treatments	Total Treatment Period (*Months*)	Total Air Dose in Roentgens			End Result
					Temporal Portal	Nasal Portal	Eye Direct Portal	
1	H.F.	2-16-33 8-25-34	46	15	10,000	2,400	—	Growth arrested 15 years and 3 months; vision 20/40; slight stationary cataract; not in pupillary area.
2	L.C.	9-29-33 4-15-35	69	19	13,044	9,594	1,800	Growth arrested 8 years; radiation cataract removed; vision 20/200 (macular changes) patient died of rhabdomyosarcoma. Patient excluded from series for statistical purposes.
3	A.G.	1- 7-35 3-23-36	65	15	13,000	11,250	1,750	Growth arrested 13 years and 4 months; vision none; eye phthisical.
4	E.A.	3-26-35 1- 3-36	78	10	11,700	7,500	4,200	Patient died 12-14-44 of sarcoma of maxillary sinus and orbit; biopsy—unable to identify definitely as retinoblastoma; classified as a retinoblastoma death.
5	B.L.	5-20-35 5-23-36	78	12	10,800	11,200	3,900	Growth uncontrolled; patient died 3-20-37.
6	R.O'R.	9-25-35 11- 3-36	105	15	14,650	14,650	3,250	Growth arrested (O.D.) 2 years; patient died of recurrence in left orbit 7-10-37.
7	J.E.	10-20-37 3-14-38	50	5	8,950	8,950	—	Growth arrested 10 years and 7 months; vision none; eye phthisical.
8	D.S.	9- 6-38 11-29-38	35	3	7,200	6,800	—	Recurrence after 5 years and 9 months; enucleation (O.U.); now free of disease 9 years and 8 months.
9	E.B.	6-20-39 9-23-41	70	22	9,150	8,940	5,200	Died of recurrent disease 7-14-46.
10	P.O.	5-24-40 9-30-40	54	4	10,800	10,800	—	Growth uncontrolled; enucleation (O.U.); patient now free of disease 8 years.
11	S.D.	4-16-41 7-11-41	38	3	7,600	7,600	—	Growth arrested 7 years and 1 month; vision 20/70.
12	P.S.	1- 9-42 3- 7-42	50	3	6,400	6,800	12,400	Died of recurrent disease 5-31-42.
13	T.W.	1-30-42 5- 1-42	40	4	7,850	7,850	—	Growth arrested 6 years and 3 months; vision 20/70; radiation cataract.
14	J.C.	4- 8-42 7- 8-42	43	3	7,600	7,600	—	Growth uncontrolled; enucleation (O.U.); died 8-10-46.
15	S.A.	5- 5-42 8- 4-42	38	3	7,600	7,600	—	Growth uncontrolled; enucleation (O.U.); now free of disease 6 years.
16	R.B.	7- 9-42 9-24-42	36	24	7,450	7,450	—	Growth arrested 5 years and 10 months; vision 3/70.
17	J.B.	8-10-42 11-25-42	40	3	8,000	8,000	—	Growth arrested 5 years and 9 months; vision 20/200. Radiation cataract.
18	S.L.	11-25-42 3- 9-43	40	4	8,000	8,000	—	Growth arrested 2 years and 8 months; vision none; lost to follow-up.
19	M.E.S.	11-27-42 2-23-43	38	3	7,600	7,600	—	Growth arrested 5 years and 5 months; radiation cataract; vision 20/200.
20	J.Z.	4- 1-43 7- 9-43	40	3	8,000	8,000	—	Died of recurrent disease; date unknown.
21	N.D.	5- 6-43 8- 9-43	40	3	8,000	8,000	—	Growth arrested 5 years; secondary glaucoma—iridencleisis; enucleation (O.U.).
22	K.C.	5-12-43 8-11-43	40	3	8,000	8,000	—	Growth arrested 1 year; recurrence in right orbit; died 11-13-44.
23	C.A.B.	6-17-43 9-18-43	40	3	8,000	8,000	—	Growth arrested 4 years and 11 months; radiation cataract; vision 10/200.
24	M.P.	4-26-44 8- 7-44	44	4	8,800	8,800	—	Growth uncontrolled; enucleation (O.U.); now free of disease 4 years.
25	R.B.	5-24-44 8-12-44	40	3	8,000	8,000	—	Growth arrested 4 years; radiation cataract; needling; linear extraction; discission; vision 10/50.
26	W.G.	7-27-44 10-30-44	40	3	8,000	8,000	—	Growth arrested 3 years and 10 months; vision poor.

TABLE 4—(*continued*)

Case	Patient	Dates of Treatment	No. of Treatments	Total Treatment Period (*Months*)	Total Air Dose in Roentgens			End Result
					Temporal Portal	Nasal Portal	Eye Direct Portal	
27	B.A.	8- 2-44 11- 3-44	40	3	8,000	8,000	—	Growth uncontrolled; enucleation (O.U.); now free of disease 3 years and 9 months.
28	R.R.	9-12-44 12-13-44	40	3	8,000	8,000	—	Growth arrested 3 years and 8 months; vision 20/100.
29	R.Y.	9-14-44 12-15-44	40	3	8,000	8,000	—	Growth arrested 3 years and 8 months; secondary glaucoma; eye phthisical.
30	P.B.	9-26-44 12-29-44	40	3	8,000	8,000	—	Growth uncontrolled; enucleation (O.U.); now free of disease 3 years and 8 months.
31	D.N.	11- 6-44 4- 2-45	40	5	8,000	8,000	—	Growth arrested 3 years and 6 months; vision 10/17.
32	W.Y.	2-17-45 5-15-45	40	3	8,000	8,000	—	Growth uncontrolled; died 7-30-46.
33	A.C.	5-18-45 8- 3-45	40	3	8,000	8,000	—	Growth arrested 3 years; eye phthisical; enucleation (O.U.)
34	M.K.	7-25-45 10-29-45	40	3	8,000	8,000	—	Growth arrested 2 years and 10 months; vision 20/200.
35	R.H.	7-26-45 10-25-45	40	3	8,000	8,000	—	Growth arrested 2 years and 10 months; vision poor.
36	G.McC.	8-25-45 11-30-45	40	3	8,000	8,000	—	Growth uncontrolled; enucleation (O.U.); now free of disease 2 years and 9 months.
37	J.G.	9-5-45 12-10-45	40	3	8,000	8,000	—	Growth uncontrolled; died 4-2-47
38	E.M.B.	10- 4-45 1- 8-46	40	3	8,000	8,000	—	Growth arrested 2 years and 7 months; vision 20/100.
39	E.L.	10- 5-45 1-25-46	40	3	8,000	8,000	—	Growth arrested 2 years and 7 months; secondary glaucoma; iridencleisis; vision poor.
40	W.M.	4- 8-46 7-10-46	40	3	8,000	8,000	—	Growth arrested 2 years and 1 month; vision 20/20.
41	M.S.D.	4-24-46 7-25-46	40	3	8,000	8,000	—	Growth arrested 2 years and 1 month; vision 20/20.
42	C.S.	5-14-46 8- 8-46	40	3	8,000	8,000	—	Growth arrested 1 year; vision 20/50.
43	G.T.	5-21-46 8-16-46	40	3	8,000	8,000	—	Growth uncontrolled; exenteration; died 6-16-47.
44	H.F.	10-25-46 1-29-47	40	3	8,000	8,000	—	Growth arrested 1 year and 7 months; vision 20/20.
45	G.H.	1-14-47 4-18-47	32	3	8,000	8,000	—	Growth arrested 1 year and 4 months; secondary glaucoma; enucleation (O.U.).
46	A.A.	2-17-47 5- 5-47	32	3	8,000	8,000	—	Growth arrested 1 year and 3 months; vision good.
47	C.T.	3-28-47 6-27-47	40	3	8,000	8,000	—	Growth arrested 1 year and 2 months; vision 20/30.
48	M.M.	3-28-47 7-16-47	40	3½	8,000	8,000	—	Growth uncontrolled; died 2-20-48.
49	G.R.	5- 8-47 8- 9-47	40	3	8,000	8,000	—	Growth arrested 1 year; vision 20/70.
50	B.M.	5-28-47 8-29-47	40	3	8,000	8,000	—	Growth arrested 1 year; vision 20/20.
51	C.J.R.	6-25-47 9-27-47	40	3	8,000	8,000	—	Growth arrested 11 months; vision 20/30.
52	C.D.	7- 8-47 10- 6-47	40	3	8,000	8,000	—	Growth arrested 10 months; vision 20/20.
53	P.E.	9- 8-47 12- 8-47	40	3	8,000	8,000	—	Growth arrested 8 months; vision 20/200.
54	F.N.	10-13-47 1-14-48	40	3	8,000	8,000	—	Growth arrested 7 months; vision 20/20.
55	W.K.	11- 3-47 2- 2-48	40	3	8,000	8,000	—	Growth arrested 6 months; vision 20/20.

posterior portion of the globe, in which the tumor lies. Cases with metastatic lesions in the anterior segment are obviously not amenable to X-ray therapy, since the dose of radiation lethal to retinoblastoma exceeds the tolerance of the structures in this area.

In our opinion, the practical size of the temporal portal (figs. 3A, 4A, and 5) is 2.5 cm. in diameter and it should be circular. Larger portals are unnecessary and, if centered over the retinal tumor, will include the anterior portion of the globe. If directed more posteriorly, there will be unnecessary irradiation of the tissues posterior to the globe. The distal, or skin end, of the temporal cone has been obliquely cut so as to fit the normal contour of the face and reduce scattering (figs. 3A and 4A). The upper, or longer edge, is placed flush with the temporal margin of the orbit, so that the center of the cone is in a direct line with the center of the external canthus. To facilitate further the positioning, a blunt, metal flange has been added to the cone (fig. 4A). This rests on the lateral orbital wall and the tip of the flange is in actual contact with the globe. Thus the upper edge of the beam is actually delineated on the globe and can be kept at least 6 mm. behind the limbus (figs. 3A and 4A).

The positioning of the nasal portal is considerably more difficult and, unless properly placed, is the chief source of injury from irradiation to the anterior segment. The cone is placed in the anophthalmic orbit at an angle of 26 to 28 degrees and directed posteriorly so as to irradiate the posterior portion of the globe, the beam passing through the base of the nose (figs. 3B and 6). A rounded lucite tip has been added to this cone to facilitate placing it in the orbit and against the nose.

As a further aid in positioning this portal, a specially curved, adjustable flange has been added (figs. 3B and 4B). It is slotted and set with screws, making it adaptable to varying interorbital distances. The flange is so set that its inner surface is on the same level and parallel to the corresponding edge of the X-ray beam. The flange is curved to fit over the bridge of the nose so that its tip comes to rest against the globe. With this as a guide, the cone can be properly angled to keep the beam behind the lens and ciliary body. The tip of the flange delineates, as with the temporal cone, the anterior edge of the beam (figs. 3B and 6). The nasal cone is circular and may be either 2.0 or 2.5 cm. in diameter. We have found that the smaller one is sufficiently large and fits better into the orbit, with less likelihood of spilling of the beam over the bridge of the nose.

The treatment factors now used by us for retinoblastoma are as follows:

Voltage	220 K.V.
Milliamperes	20 M.A.
Target skin distance	50 cm.
Filters	0.5 mm. Copper + 1.0 mm. Aluminum
Half-value layer	1.0 mm. Copper
Portal size	
Temporal	2.5 cm.
Nasal	2.0 cm.
Position of portals (figs. 3a, 3b, 5, and 6)	
1. Temporal	directed transversely
2. Nasal	directed obliquely
Frequency of treatments	3 times a week; alternating portals
Single dose	400 r (in air)
Maximum total dose	8,000 r × 2 (in air)

If the tumor does not regress after the maximum total dose, or should it show evidence of regrowth after several months, further irradiation not only is useless, but invariably will bring on sequelae ending in blindness.

Skin reactions. The dosages given above are, as stated, calculated in air. Reference to any standard-depth dose tables will make it evident that, while the tumor dose is approximately 4,500 r × 2, the skin dose is 9,000 r to each portal. Erythema will inevitably result so that the proper care of the treatment areas is of utmost importance if the therapy is to be continued. As mentioned

before, there is considerable individual variation in the reaction to the X rays—some individuals showing only a faint erythema, while others occasionally have rather severe blistering. We formerly believed that, as with other actinic rays, blondes would show the greater reaction, but numerous cases have proven this to be an untenable premise.

After 1,200 to 1,800 r have been given to a portal, the erythema is first noted. At this time, the parents are carefully instructed to keep the area covered at all times with plain white vaseline or boric-acid ointment. Direct exposure to sunlight is contraindicated, for irradiated tissue reacts poorly to actinic rays. This applies equally to the skin during and after treatment.

As the treatment progresses, the erythema increases but, after 2,400 to 3,600 r (in air) have been given, it tends to subside, only to flare up again toward the end of the treatments. Increased pigmentation appears around the periphery of the portal during the last half or third of the treatments. Within 6 to 8 weeks after the cessation of treatment, the erythema has usually disappeared.

Aside from any individual sensitivity in the skin reaction, the severity of the reaction is, in large measure, inversely proportional to the care the area receives. Much ingenuity is required of the parents to keep the treatment areas well greased, but perseverance is rewarded. Ulceration has been rare and, when present, has never been severe. Reinstruction of the parent has resulted in prompt healing, and in no instance has it been necessary to discontinue therapy because of dermal reaction. The large majority of patients show only varying degrees of erythema. The nasal portal consistently shows considerably less reaction than the temporal. The difference in reaction may partially be explained by the difference in size of the two portals. The conjunctiva at both canthi show moderate injection but tearing is never a problem. The cornea shows no reaction whatsoever, if the portals are properly placed.

Reëxamination of child under general anesthesia

During the first 14 years of the project each child, while under treatment, was examined under general anesthesia at monthly intervals. This was done to determine the progress of each case and to ascertain the development of any untoward complications. Reëxaminations during therapy are now felt to be unnecessary except in those patients with advanced lesions in whom the prognosis is doubtful and in whom continued growth is feared. The monthly follow-ups have grown to such proportions that this curtailment has been made necessary.

Upon completion of treatment each patient is reëxamined, under anesthesia, and thereafter at monthly intervals for the first six months, if possible. The distances which many of these patients travel, and the expense attached thereto, frequently make this impossible. Such patients are seen at 3-month intervals. We prefer, after the initial 6-month posttreatment period, to follow each child at 3- to 4-month intervals for at least three years, then at 6-month intervals for the next two years, and yearly thereafter.

Such a follow-up program, particularly in its present proportions, precludes hospitalization of these children for ether anesthesias. During the past 15 years, all these examinations have been done under chloroform anesthesia given, until the past year, in one of our private offices. No other anesthetic agent has been found to equal chloroform in ease of administration, rapidity of induction and recovery, safety and freedom from nausea, vomiting, and other after-effects. The details of its administration were given in the previous report.[3] In over 350 examinations in the past 15 years no untoward complication has occurred with the use of this anesthesia.

Summary

The results of 15 years of treatment of bilateral retinoblastoma by the combined method of surgery and irradiation are presented. Fifty-five such patients (table 4) have been treated by this method, of whom 53 are available for statistical analysis—two having been eliminated for the reasons given. Of the total series 25, or 47.2 percent, are living with vision of 20/200 or better; 16, or 30.2 percent, are living without vision; and 12, or 22.6 percent, have died of retinoblastoma. In the group followed 5 years or more there is a total of 19 persons. Of these, 6, or 31.6 percent, are living, with vision of 20/200 or better; 6, or 31.6 percent, are living without recurrence but are blind; and 7, or 36.8 percent, have died of the disease.

The early recognition of the tumor in the second eye and its importance in the therapy is discussed. The clinical course of the tumor following radiation and the complications attendant thereto are described. The technique of therapy and the method of follow-up are presented.

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Ophthalmic miniature

The separation of the ophthalmic department from the rest of surgical practice has generally been considered of recent occurrence; it is, on the contrary, very ancient, and perhaps coëval with medicine itself. Among the Egyptians, to whom we trace the origin of arts and sciences, each class of diseases had its physician; and we find from Herodotus, that Cyrus sent to Amasis, the king of Egypt, for an oculist. The Greeks and Romans had their oculists, as is evident, not only from their writings, but from the inscriptions on ancient marbles and seals. That Augustus and Tiberius were thus provided is apparent from the following inscriptions: P. Attius Atimetus Augusti medicus ab oculis; Tit. Lyrius Tiberii medicus ocularius. There is no doubt that oculists were at least as numerous in ancient Rome as in any modern city.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

TRAUMA TO THE HEAD WITH PARTICULAR REFERENCE TO THE OCULAR SIGNS*

Part I. Injuries involving the cranial nerves

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Trauma to the head frequently produces ocular signs which are important both as regards diagnosis and treatment. Such signs, which are of equal interest to neurologists, neurosurgeons, and ophthalmologists, cannot be evaluated intelligently unless they are integrated with the other signs of head injury. With this in mind it has seemed worthwhile to present a reasonably detailed account of observations concerning cases of acute trauma to the head.

What may be considered as "pure" ophthalmologic conditions—for example dislocation of the globe, corneal lacerations, and isolated orbital involvements—are not discussed. Ocular symptomatology which is dependent upon lesions affecting the visual system at the cerebral integrative levels (association pathways) is not considered in any detail in this paper. Neurologic and neurosurgical descriptions are given in summary form. The descriptions are admittedly incomplete, but it is hoped they are sufficiently comprehensive that they may help the ophthalmologist better to understand head injuries and their ocular signs.

The subject matter is included under the following headings: (1) General discussion of acute head trauma; (2) systemic study of involvements of the cranial nerves; (3) hemisphere and brain-stem lesions; and (4) miscellaneous conditions.

1. General discussion of acute head trauma

a. Direct blows; Contrecoup, crushing and gunshot injuries

Injuries to the head are a common occurrence but, due to many protective mechanisms, injury to the central nervous system occurs infrequently. Flexibility of the neck, the nature of the bones of the skull (open sutures in infants; the arrangement of the vault bones in tables), and the presence of a bed of cerebrospinal fluid, all serve to absorb and diffuse trauma and thus protect cerebral tissue.

Direct blows are most common. This type of injury results from an object moving rapidly through space and striking a stationary head, or from the head moving rapidly through space and striking a stationary body. The severity of the injury varies directly with the mass and velocity of the moving object, with the direction of the trauma at the instant of contact, and with the capacity of the head to move in the same direction as the force applied to it. Similarly, if the head while moving strikes an immovable structure the injury is more severe than when the object moves as a result of the head striking it.

A sequela of the direct blow is the contrecoup injury. In such an instance the brain is injured on the side opposite to the applied force. Injuries to the parietal and temporal regions are most frequently complicated by contrecoup injuries. Why blows in these regions are particularly apt to produce contrecoup injuries is not thoroughly understood. Probably the applied force produces a rotating motion of the brain, which in turn forces the cerebral tissue against the rigid skull.

Injury to the brain occasionally originates in transmission of force from a distal portion of the body. Such injury is exemplified by Dandy's observation of total and permanent blindness dependent upon an individual sitting down forcibly.[1] We have

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observed basilar fracture around the foramen magnum and signs of brain-stem damage as a result of force applied to the base of the spine.

Crushing injuries to the head, often associated with extensive fractures and lacerations of the brain due to indriven fragments, may not produce loss of consciousness. Fixation of the head undoubtedly is significant because when the injury is at all severe and the head is not fixed loss of consciousness is the rule. Seemingly, when the head is movable the force is widely distributed. Why a widespread slight disturbance is often associated with loss of consciousness cannot be answered with certainty. From a clinical standpoint slight injuries to a movable head produce loss of consciousness; whereas, crushing injuries tend to produce local injury with its attendant signs and are less likely to produce loss of consciousness.

Reference should be made to the experimental work of Denny-Brown and Russell.[2] These investigators found that, using a pendulum as a striker and allowing the head of of an experimental animal to move, a critical acceleration was necessary to produce concussion (28.3 feet per second; energy, 17.83 foot-pounds). Animals could be killed without any microscopically visible changes occurring in the brain. The authors concluded that concussion is a direct traumatic paralysis of nervous function without a vascular lesion. Concussion is due to transitory paralysis of the centers in the medulla and bulb. It can be produced in decerebrate animals. Death in such animals is due to failure of blood pressure which is precisely the same as that of primary surgical shock. These investigators showed that paralysis of concussion was immediate, due to direct physical injury to the neurons, and that it was reversible. When petechial hemorrhages were found they were attributed to squashing or stretching of the blood vessels.

Contusions of the cerebral hemisphere influence the bulbar centers when pronounced increase of intracranial pressure is produced by hemorrhage. Denny-Brown states that concussion produced by a crushing-type injury with the head resting on a hard surface requires a much greater force.

Gunshot wounds present a special problem. The low-velocity bullet (pistol or small-bore rifle) may not penetrate the skull but may produce a depressed fracture which contuses or lacerates the brain. The high-velocity bullet (rifle or machine gun) is likely to cause extensive brain damage beyond that produced by the local impact, and damage to cerebral structures far from the point of impact is the rule.

Knife and pick wounds are seen occasionally. Neurologic signs when they are present are due to direct injury to the cortex or underlying tracts. Bleeding may obscure the signs.

In addition to the cerebral damage produced by the initial injury, other signs which are dependent upon bleeding may develop. This applies to all types of head injury whether penetrating or nonpenetrating.

Extradural hemorrhage is a complication of injury to the head, and such hemorrhage is usually lethal unless it is controlled by operation. In general it may be stated that the effects of hemorrhage are delayed; whereas, those produced by the initial injury are immediately manifested. Furthermore, speaking generally, the signs of hemorrhage tend to be progressive; whereas, those due to cerebral damage tend to regress after 48 hours.

In addition to extradural bleeding other types of hemorrhage may develop: acute subdural, subarachnoid, and intracerebral. As with extradural hemorrhage, subdural hemorrhage should be evacuated when it is detected. Subarachnoid hemorrhage does not determine the prognosis in the individual case. Such hemorrhage is diagnosed on the basis of examination of the cerebrospinal fluid obtained by lumbar puncture. Neither subarachnoid hemorrhage nor intracerebral hemorrhage can be treated satisfactorily during the acute stage of head injuries. In our

opinion repeated lumbar punctures have no place in the treatment of such injuries.

b. Fractures of the skull

These are described in great detail in some texts and have been considered by laymen and the uninitiated as of great significance. Actually the state of the skull bones in itself is of relatively little importance. Damage to the underlying brain and blood vessels is vitally important.

There are three types of skull fracture (1) linear, (2) depressed, and (3) compound.

Usually linear fractures are of little importance other than that they signify severe trauma. They are frequently found in individuals who have not even momentarily suffered unconsciousness. Whether such a fracture is at the vault or base is in itself unimportant. However, such fractures may pass through a pneumatic sinus and produce a threat of meningitis, or they may rupture a blood vessel and produce intracranial hemorrhage. A linear fracture through the cribriform plate may produce rhinorrhea.

c. Symptoms of acute closed injury

In all closed head injuries there are two questions which require answer. Is the intracranial pressure increased? If it is increased is it being tolerated? The evaluation of the symptoms of acute closed injuries requires experience. Unfortunately there is no systematic schema which can be routinely followed and it is unusual for one examination to suffice.

The state of consciousness is the most important consideration. Any individual who has suffered unconsciousness as a result of a blow on the head should be kept under observation for 8 or 10 hours after recovery of consciousness. As consciousness is recovered and the patient becomes lucid, the surgeon may justly become confident that the injury will be survived.

Prolonged or deepening unconsciousness usually signifies extensive cerebral damage or progressive embarrassment by hemorrhage and edema. In the absence of all other signs and symptoms, prolonged or deepening unconsciousness demands multiple exploratory trephinations to determine the presence or absence of subdural or extradural hemorrhage.

Other phenomena of importance are (1) the pulse rate, (2) respiratory rate and rhythm, (3) temperature, (4) blood pressure, and (5) localizing signs.

1. The pulse rate usually is lowered as the result of increased intracranial pressure. If it remains above 60 beats per minute one may assume (in the absence of other signs) that the brain is compensating for any increase in pressure or for any edema which may have developed. If the pulse rate which has been steadily falling exhibits alternating periods of bradycardia and tachycardia, the prognosis is grave since this is evidence of a break in compensation. As regards bradycardia it is necessary to recall that occasional individuals have a "normal" rate of 40 to 60 beats per minute. This also is true of individuals under the influence of digitalis. A pulse rate of below 60 beats in a conscious individual is rarely significant but in an unconscious person it should be considered as a sign of increased intracranial pressure until proven otherwise.

2. The respiratory rate is depressed as the intracranial pressure increases. A rate of 14 to 16 per minute need cause no great concern but when it falls below this the outlook is ominous. The rhythm which at first is regular may become irregular, and respirations may become noisy and be of the Cheyne-Stokes variety, or there may be development of Biot's breathing. Such changes indicate a break in compensation.

3. The body temperature is usually increased, possibly as the result of increased intracranial pressure, intraventricular bleeding, and absorption of necrotic brain. However, a person who has suffered from exposure and shock may have a normal or even a subnormal temperature when the intra-

cranial pressure is elevated. A rectal temperature of over 100°F. usually signifies a considerable elevation of intracranial pressure. In the instance of subarachnoid bleeding the temperature increase is greater than with subdural or extradural hemorrhage. However, with subarachnoid hemorrhage, increased temperature is not as reliable an index of increase in the intracranial pressure as it is with extradural and subdural bleeding.

4. The blood pressure varies considerably with the severity of the head and concomitant injuries. Denny-Brown[3] has shown that within 10 seconds there is a rise at the time of injury. This is later followed by a fall and it may reach shock levels. This may be due to paralysis of the vasomotor centers, or it may be the result of hemorrhage or severe injury elsewhere in the body. Later, if increased intracranial pressure develops, the blood pressure tends to be elevated. We have observed systolic blood pressures of over 300 mm. Hg in the presence of high-grade intracranial hypertension. When compensation begins to fail the pressure becomes irregular and may fall with startling abruptness. Not infrequently the blood pressure has failed to rise with the intracranial pressure. We feel that observations concerning the blood pressure are not always reliable as regards the intracranial pressure.

5. Localizing signs are important in diagnosis particularly if the time and order of their development is known. Cranial nerve palsies, hemiplegias, and monoplegias which appear immediately following the trauma establish the location of the cerebral injury. Such phenomena are not reliable guides as regards prognosis. Paralyses at first tend to be complete but there is a distinct tendency toward regression. There is no parallelism between the completeness of the palsy and the general state of the patient.

Generalized convulsions are usually due to cortical lacerations or to subarachnoid or intraventricular bleeding. Jacksonian fits localized to the face and arm are usually due to hemorrhage which requires operation; such fits suggest extradural or subdural hemorrhage. These patients should have a trephination promptly.

d. Complications of head injuries

Subdural hydroma. The subdural collection of cerebrospinal fluid is thought to be due to a small tear in the arachnoid which produces a valvelike action. Again the symptoms and signs are slight and indefinite and similar to those of subdural hematoma. They can occur at any age and usually produce symptoms sooner after injury than in the instance of subdural hematoma.

Stricture of the aqueduct of Sylvius. This may occur following trauma which has produced hemorrhages in the midbrain. The resulting swelling deforms and may occlude the canal and thus produce hydrocephalus. This sequence of events is rare.

Meningitis. This may occur following a fracture through a sinus of the inner ear, or a compound fracture of the vault. Fractures through the inner ear heal insecurely and even slight trauma may rupture a delicate scar so that the hazard of meningitis following a basilar fracture is present for the remainder of the patient's life.

Chronic ear infections. Infrequently these follow fracture through the aural canal or mastoid region. They should be treated vigorously since their extension may result in meningitis and brain abscess.

Rhinorrhea. This follows fracture through the frontal sinuses or the cribriform plate. The vast majority of these heal spontaneously within 10 days after the injury and conservative treatment is indicated during this period. If the outflow of fluid persists, closure of the fistula is indicated. When it persists, it is almost always due to increased intracranial pressure produced by adhesions. Rarely air is forced back into the cranial cavity. This is discussed subsequently.

Epilepsy. This is a common and distressing sequela of head injuries. The incidence varies considerably but probably it appears

in 35 to 40 percent of individuals who have sustained a severe injury. Closed injuries of all types produce epilepsy in 2 or 3 percent of cases. When the skull is fractured but the dura remains intact, the incidence rises to 5 percent. In more severe injuries in which the dura is torn and the cortex lacerated, the rate rises to 15 percent. Occasionally such epilepsy is cured by elevation of a depressed fracture or excision of a cortical epileptic focus. Usually liberal use of anticonvulsants is sufficient treatment.

Personality changes. These are often present in individuals who have suffered head trauma. Such changes probably result from diffuse petechial hemorrhages or from laceration of the base of the frontal or temporal lobes. Some authors believe personality change is due to neuronal damage rather than hemorrhage. Headaches and fatigue may be the principal complaints. Loss of memory, slurring of speech, careless habits, and marked emotional instability are frequently present in adults. Profound mental deterioration sometimes occurs in children.

2. Systematic study of involvements of the cranial nerves

Injuries to the cranial nerves usually follow blunt trauma, although occasionally nerves are severed by bullet or knife wounds. There are several ways in which the nerves may be injured: (a) Fracture through the foramen or canal through which the nerve passes, (b) bruising of the nerve against the bone, (c) disruption of the blood supply to the nerve, (d) local pressure caused by hemorrhage or edema, (e) torsion of the brain causing avulsion of the root. Often it is impossible to distinguish the mechanism which is responsible.

Fractures of the base of the skull nearly always come down from the vault. Extensive fractures of the base are not unusual after what appears to have been a mild head injury with little or no loss of consciousness. It is difficult to demonstrate fractures of the base by X ray, and negative X-ray studies should not be considered as ruling out a bony lesion.

There may be regeneration of motor cranial nerves providing the roots have not been avulsed from the brain stem. The regeneration is rarely complete. The phenomenon of misdirection of fibers may develop notably in the third and seventh nerves. Sensory cranial nerves do not regenerate if injured at the site of the ganglion or root, and recovery of function in such instances can only be explained on the basis of the block having been physiologic.

The incidence of injury to the cranial nerves in a series of cases of head injury has been given by Turner,[4] who did not include injuries to the eighth nerve. Among 1,550 cases of head trauma, there were 242 involvements of the cranial nerves. These were as follows:

Nerve	Injuries
1	119
2	25
2 (chiasm)	3
3	15
4	15
5	3
6	15
7	46
10	1
Total	242

Injuries to the first nerve

The olfactory nerve is frequently injured. Generally the disability is slight and it is often unnoticed by the patient. In order to test the function of this nerve, the patient must be alert and intelligent. The test odors must be easily recognized and not sufficiently powerful to stimulate the pain fibers of the fifth nerve. Findings may be complicated by a history of long-standing nasal infection which has destroyed nerve endings before the trauma to the head occurred.

Injuries to the filaments or bulbs are

brought about by fracture through the anterior fossa, especially by a fracture passing through the cribriform plate. Blows on the occipital region not infrequently produce anosmia. In such an instance the entire brain is shifted in a posterior-anterior direction and, during the course of the movement, the filaments to the end-organs are ruptured. This is quite the opposite to contrecoup which may, however, produce precisely the same effect.

Anosmia may be partial or complete. There is no subsequent return of function. Usually the loss of smell is of little consequence to the person affected. Occasionally, however, such loss is a serious matter, as for example when it occurs in chefs or chemists.

Injuries to the Second Nerve
The Optic Nerve

General Discussion

As with the other cranial nerves, the mechanisms responsible for injury are not fully understood. Direct injuries are for the most part associated with fractures of the skull and section or laceration of the optic nerve by bullets or knives. Indirect injuries occur frequently. In such instances the pathogenesis of the visual defect is not established with certainty largely because death does not occur and autopsy studies are not available.

The optic nerve in its intraorbital portion is about 25-mm. long and exhibits two curves which permit free movements of the eyeball without stretching of the nerve. Because of its free mobility within the orbit, the optic nerve in this situation is relatively rarely damaged except by being actually severed or lacerated. If a blunt instrument is forced into the orbit, damage to the nerve usually occurs either at the posterior pole of the eye or where the nerve is firmly attached to the optic canal. The canal is 4- to 5-mm. long, and at this site the nerve is immobile. The intracranial portion of the optic nerve is 4- to 10-mm. long.

Direct Injuries to the Optic Nerve

Division of the optic nerve. If the optic nerve is divided close to the eyeball there is immediate development of pallor of the optic disc and extreme narrowing of the retinal arteries. The ophthalmoscopic picture is that which follows sudden obstruction of the central retinal artery. We have observed this as the results of a knife and of a bullet wound. Also we have observed from a wound with a stilleto severance of the optic nerve behind the entrance of the central retinal artery; there was total blindness on the side of the injury but a normal fundus for about two weeks after the occurrence of the injury. Thereafter the optic disc became extremely pale and there was attenuation of the retinal arteries.

Fracture of the optic canal. The optic nerve is vulnerable to injury as it passes through the optic canal, and it is obvious that fracture through the canal would result in direct injury to the nerve. There are many statements in the literature which would indicate that such fractures into the canal occur frequently.[5] Probably they occur extremely infrequently. Pfeiffer[6] has found they are infrequent, as also has Turner.[7] Dr. James Watts[8] has told one of us (F. B. W.) of a single case in which at exploration he found a spicule of bone from the wall of the canal thrust into the optic nerve. The celebrated cases of Lillie and Adson[9] are proof that the canal may occasionally be the site of fracture and callus formation. In their two patients, following a cranial trauma by several weeks, there was the development of a central and a ring scotoma in the field of the affected eye. Further X-ray studies showed a "crack" fracture. At operation unroofing of the optic canal allowed recovery of function to occur. Their cases are unique.

Avulsion of the optic nerve. This usually occurs as a result of traction on the optic nerve as, for example, when a blunt instrument is thrust into the orbit. The nerve is not cut through but is pulled out of the posterior scleral foramen. In such cases the diagnosis usually cannot be made at once because frequently there is intraocular hemorrhage as a result of the trauma. When the blood has absorbed, an excavation is seen at the site of the optic disc. We have observed a single case in which avulsion of the optic nerve occurred as a result of a blow on the eye. The optic nerve was displaced posteriorly in the same manner that a cork is forced out of a bottle by striking its butt on the wall.

Indirect Injuries to the Optic Nerve

Such injuries have been carefully described by J. W. A. Turner[10] whose paper we have used extensively. It is a valuable contribution to our knowledge of head injuries in that it establishes a definite pattern regarding the course of injuries to the optic nerve when they arise as the result of transmitted force.

Site of injury. Usually the site of head injury is the forehead, the supraorbital ridge, or the external angular process on the side of the visual loss. Posterior injuries, according to Turner, rarely produce loss of vision as a result of damage to the optic nerves.

Severity of the injury. Indirect injury to the optic nerve may develop as a result of slight trauma. Usually the severity of an injury is estimated by the duration of the posttraumatic amnesia. However, when there is indirect injury to the optic nerves there may or may not have been loss of consciousness. Frequently there is no evidence of fracture.

The pattern of visual loss. Turner stresses the fact that the visual loss is immediate. If the injured person remains conscious he complains of visual loss at once; in no instance has blindness been delayed in its appearance. In many instances improvement occurs, and in a majority of Turner's cases there was improvement within 3 or 4 days after the accident. The loss of vision may be total yet improvement or recovery may occur. This improvement in vision tends to progress for 3 or 4 weeks when it reaches the maximum it will attain. Subsequent deterioration of vision has occurred infrequently.

The visual field defects. The visual field defects in Turner's cases fell into two general categories: a scotoma, either central or paracentral, and sector defects. The field defects cleared as improvement occurred. Particular mention of the blindspot was not made in Turner's study. Hill[11] some years ago reported on transient enlargement of the blindspot as a frequent occurrence in cases of trauma to the head. Furthermore, he stated as his belief that if, after 12 hours, the blindspots continue to show enlargement, edema of the brain is present whether or not there are ophthalmoscopically visible changes or other signs. He cited Evans's[12] explanation that enlargement of the blindspot associated with increased intracranial pressure can be explained on the basis of the retina adjacent to the disc being supplied by twigs arising from the vascular circle of Zinn. Transmitted force reaching these vessels interferes temporarily with the retina surrounding the optic disc, hence the enlargement of the blindspot. We are not in a position to discuss enlargement of the blindspot as an ocular sign of head trauma, but it seems probable that many cases described by Hill belonged in the group discussed by Turner.

The pupil. In the cases observed by Turner there regularly was some degree of sluggishness of the pupil on the side of the visual loss to direct light stimulation, but the pupillary response to indirect light stimulation was rapid and normal. There was not the development of anisocoria such as occurs in some cases of subdural and extradural hemorrhage.

The optic fundus. In a great majority of these cases, the fundus appears normal. In some instances there are a few retinal hemorrhages seen a day of two after the accident. Turner attributes these to coincident injury to the globe. The optic disc is characteristically normal until about three weeks after the injury when there is development of varying degrees of pallor.

Pathogenesis of loss of vision due to indirect injury. The development of pallor of the discs within about three weeks after the injury suggests that the optic canal is probably the site of injury to the optic nerve. This also would seem to be the site on the basis of the anatomy.

Turner suggests that as a result of injury there either are thromboses of the small vessels which supply the optic nerve, or intraneural hemorrhages. This explanation also has been advanced in cases of "rupture" of the chiasm resulting in traumatic bitemporal hemianopia.

We suggest that intraneural hemorrhages are an unlikely explanation, at least in cases of indirect injury in which recovery occurs. Such hemorrhages would probably excite glial tissue formation and this would eliminate the possibility of recovery or would account for later regression of vision.

Hemorrhage into the Optic-Nerve Sheaths

Hemorrhage into the optic-nerve sheaths has been considered as a cause of loss of vision. Actually it is impossible to state with any degree of finality the precise importance of hemorrhage into the optic-nerve sheaths. Such hemorrhages are found as a result of trauma. Liebrecht[13] stated they developed in over 50 percent of cases of fracture of the skull. Best[14] remarked on the frequency of bilateral subdural hematoma of the optic-nerve sheaths in fatal bullet wounds of the head, and cited such occurrences in 41 of 45 such cases. Pringle[15] stated that such bleeding occurs as the result of rupture of vessels within the dura or from the central retinal vessels. In several cases of ruptured aneurysm, we have observed blood in the spaces about the optic nerve of one or of both sides.

In the autopsy material we have studied, it was difficult, and usually impossible, to be satisfied that the bleeding was confined to the subdural or to the subarachnoid space within the orbital portion of the nerve.

In regard to the spaces surrounding the optic nerve within the orbit, it is of interest that Whitnall[16] regarded the subarachnoid space as a potential space only; whereas, Cone and MacMillan[17] considered the subdural space to be potential only. That bleeding within the cranium may be continuous with bleeding within the optic-nerve sheaths in the orbit has been proved on many occasions. Very recently Miller and Cuttino[18] reported such an interesting observation in a case of ruptured intracranial aneurysm; they were able to trace the blood through the spaces about the optic nerve within the optic canal and into the same spaces within the orbit.

Hemorrhage within the optic-nerve sheaths probably is a factor in the production of papilledema and of preretinal hemorrhages in some cases. However, in such cases the presence of blood in the perineural spaces within the orbit is not an essential factor since, if present-day concepts regarding the production of papilledema are approximately correct, pressure transmitted from the intracranial cavity is the principal factor and not the nature of the fluid transmitting the pressure. In the instance of rupture of intracranial aneurysm, Ballantyne[19] recently expressed doubt that there is a continuity of bleeding from the cranial to the orbital subarachnoid space.

In this paper we do not propose to pursue this subject further other than to make the following general statements. Hemorrhages into the optic-nerve sheaths occur as the result of injury to the head. We have observed them in cases of subdural hematoma,

subarachnoid bleeding from rupture of intracranial aneurysm, and following a prefrontal lobotomy. Continuity of hemorrhage from the cranial subarachnoid to the orbital optic perineural spaces has been demonstrated. It is of interest that Whitnall's concept regarding these spaces was not that expressed by Cone and MacMillan.

There is doubt in our minds as regards the exact location of hemorrhage in the autopsy material we have available for study. Transverse serial sections are almost certainly essential to a decision in this regard.

Bleeding into the optic-nerve sheaths may be a factor in the production of preretinal hemorrhages and papilledema, presumably from an obstructive effect on venous outflow from the eye. In indirect injuries to the optic nerve, hemorrhages into the optic-nerve sheaths are probably incidental as regards the loss of vision.

Injury to the Optic Chiasm

Injury to the chiasm results in so-called traumatic bitemporal hemianopia in some instances. We have observed several such cases. In them there has been an immediate period of unconsciousness and when the visual functions could first be tested the field defect has been present.

Traquair, Dott, and Russell[20] described such cases and expressed the belief that in them there usually is not disruption of fibers, but rather there is injury to small vessels supplying the chiasm, as has been suggested in the instance of injury to the optic nerve within the optic canal or intracranially. Hughes[21] described such a case in which the visual acuity was 6/9. At operation no lesion of the chiasm could be seen.

In our cases the visual acuity has been relatively good. One individual had suffered injury 10 years before he came under our observation. Through the courtesy of Dr. Joseph Dessoff[22] we have observed a patient in whom there was a loss of hemianopic pupillary response in both eyes, a bitemporal hemianopia, vision of 20/20 for each eye, and extreme pallor of the optic discs several months after injury.

Yaskin and Alpers[22a] have reported a most unusual involvement in the general region of the chiasm. Following a closed head injury with fracture of the occipital bone, their patient developed concentric constriction of the visual fields and what appeared to be an atypical Foster-Kennedy syndrome. The sense of smell remained intact. At operation there was a dense arachnoiditis about the chiasm and left optic nerve. There was marked dilatation of the ventricular system.

Injury to the Optic Tract

Undoubtedly direct injury may result in damage to the optic tract, but we have not had experience with such occurrences. It seems highly probable that such injuries may occur on the basis of interference with blood supply as already described.

In tract lesions the presence of hemianopic pupillary rigidity serves to differentiate the site of the lesion between the tract and the radiation. In the latter situation the pupillary responses to light remain normal.

We have observed irregular homonymous quadrantic defects in cases of fracture through the middle fossa. Whether the field defect was associated with damage to the tract or to the radiation or to both was not clear.

Injuries to the Third Nerve

Pupillary Phenomena Associated With Trauma

The dilated pupil associated with direct injury to the eye. Not infrequently after direct trauma to the eye or orbit, such as a blow from a fist, there is widening of the pupil, which is often irregular, and loss of response to light or sluggishness of such response; both direct and indirect pupillary reactions to light are slowed or lost. In some such cases there is rupture of the sphincter

iridis. A pupil which is dilated as a result of injury usually constricts promptly when eserine is instilled into the conjunctival sac. Pupillary dilatation after injury may persist for only a few hours or days but sometimes it is permanent. A dilated pupil is occasionally observed in an individual who also has a slow pulse as part of the oculocardiac reflex; this is discussed subsequently. Both with large and with small pupils the possibility of posterior synechias interfering with the mobility of the pupil must be considered.

The dilated pupil associated with subdural and extradural hemorrhage. The maxim that search should be made for extradural and subdural hematoma on the side of the dilated pupil usually is sound. Woodhall and his associates[23] have shown that transient widening of the pupil of one side has the same localizing significance as pronounced and more persistent widening.

Several observers, one of the earliest being Jefferson,[24] have shown that pressure of a subdural or extradural hemorrhage, or of a tumor, may produce herniation of the temporal lobe through the tentorium. This results in direct pressure on the third nerve in which the pupillomotor fibers seemingly are situated peripherally. As a result the pupil is dilated. Often there is some degree of ptosis, rarely complete.

It is equally possible that angulation of the brain stem occasioned by the changed position of the temporal lobe may produce a pull on the third nerve.

In cases of subdural hematoma and extradural hematoma the block is physiologic. This is supported by the rapid recovery of the pupil to normal size when the hematoma is evacuated.

Notably in the series described by Kennedy and Wortis[25] the side of the pupillary widening was not a true indication of the side of the lesion. We have observed unilateral pupillary change in some cases when bilateral hematomas have been discovered. When, as is sometimes the case, the hemorrhage is found on the side opposite the dilated pupil it would seem possible that the closed injury has resulted in herniation of the opposite temporal lobe, although this has not been proven so far as we are aware.

If a hemiplegia is present, it usually affects the side opposite the widened pupil. Occasionally the abnormal pupil and the hemiplegia are on the same side. In such an instance the brain stem has been displaced laterally.

Differential Diagnosis "Large Pupil"

When there is a large pupil on one side the following considerations require attention before it is assumed the pupillary state is due to a collection of blood.

a. *Anisocoria* may be physiologic. In such instances both pupils exhibit normal direct and indirect responses to light.

b. *Anisocoria* may be associated with unilateral blindness. The dilated pupil responds normally to indirect but not to direct light.

c. *Anisocoria* may be due to use of a cycloplegic (atropine, and so forth). Eserine will not produce narrowing of such a pupil.

In no instance of head injury should the pupils be dilated until the diagnosis is established as regards the nature and site of the intracranial damage.

d. *The "tonic" pupil* described by Adie[26] is usually a large pupil, and usually only one pupil is affected. Although not strictly relevant to the title of this paper, the following comments on this type of pupil are included. In our experience Adie's descriptions apply only in part. We have rarely observed loss of accommodative power in such cases but Morgan and Symonds[27] have observed that such loss occurs when the pupillary change is only recently present. The extreme miosis on prolonged convergence described by Adie has been observed infrequently by us. Narrowing of the tonic pupil by use of a weak solution of mecholyl as described by Scheie[28] has been obtained in our cases. This response suggests that the lesion is in the ciliary ganglion.

e. *The fixed and dilated pupil* which reacts neither to direct nor to indirect light stimulation may be indicative of several conditions. It has already been described as due to prolapse of the temporal lobe and resultant pressure on the third nerve. It may be related to the so-called Adie's tonic pupil as has been indicated. Finally, it may represent processes in which there seemingly is obstruction of the afferent pupillary pathway such as is observed in juvenile general paralysis and lesions around the quadrigeminal plate (usually tumor). In the last-named instances the pupillary change is usually bilateral; whereas, in the other conditions previously mentioned usually it is unilateral.

f. *Bilateral dilated and fixed pupils* are observed after some severe head injuries. In such instances the eyes are usually diverged. Such pupils indicate a grave prognosis probably because the lesions responsible are in the midbrain. We have recently observed one such case in which one pupil narrowed for a few hours, but again widened before death occurred.

The "Small" Pupil Associated With Cranial Trauma

a. *Congenital miosis.* It has already been remarked that anisocoria may be physiologic, that is, one pupil may be larger than the other and both may be normal. Congenital miosis, a condition in which there is thought to be absence of the dilator fibers, is characterized by incomplete pupillary dilatation when a cycloplegic has been instilled. In our experience congenital miosis has always been bilateral. Such pupils well might cause confusion in the evaluation of a cranial trauma.

b. *The acquired small pupil* may have its origin as the result of instillation of a miotic drug.

c. *So-called irritative miosis* in which the pupils are small is observed rather frequently in individuals suffering from meningitis. Such pupillary changes, either unilateral or bilateral, occur as the result of trauma when hemorrhages have occurred in the brain stem. In this instance it seems probable there is interruption of the sympathetic pathways at this level, but this alone would not account for the pinpoint pupils observed in proved cases of intrapontine hemorrhage. Another factor must be present to account for the extreme pupillary narrowing. Undoubtedly there is parasympathetic stimulation present and it probably exists on the basis of anoxemia.

Extremely narrow pupils in an individual who has suffered a head trauma indicate "central" damage. With such pupils the outlook is grave but they do not have the ominous significance of fixed and dilated pupils.

d. *Horner's syndrome.* Interruption of the sympathetic chain in the neck results in the classic Horner's syndrome. In addition to narrowing of the pupil, there is ptosis and absence of sweating on the homolateral side of the face. In our experience enophthalmos is absent almost invariably. If the sympathetic chain is interrupted after it has entered the cranium with the carotid artery, that is, peripherally, only ocular signs are apparent. There is ptosis and narrowing of the pupil. Theoretically either of these signs may appear alone.

Ectopia pupillae. Rather often this is a physiologic phenomenon. It is normal for the pupil to be situated somewhat in and down from the center of the cornea. When displacement of the pupil occurs there is true ectopia. The condition may be familial when it has been shown to have been transmitted as a dominant or as a recessive character. Not infrequently ectopia pupillæ is observed when the eye is being operated upon.

As far as we are aware pupillary displacement is not associated with injuries to the skull although it may occur in some degree when the eye has suffered a direct blow. It has been described as not an uncommon accompainment of pineal tumor, and tumor of the third ventricle. Kinnier Wilson[29] observed it under these circum-

stances and also in a case of disseminated sclerosis.

Hippus. So far as we are aware this peculiar phenomenon has no importance in cases of injury to the skull, and whether or not it is produced by trauma we do not know.

Injuries to the Third Nerve

Within the orbit. Orbital injuries not uncommonly produce paralysis of the levator palpebral superioris and superior rectus because these two muscles are supplied by the superior terminal branch of the nerve. The branch to the inferior oblique muscle is supplied by the inferior divison which also supplies the medial rectus. We have observed internal ophthalmoplegia associated with isolated palsy of the inferior oblique: the fibers to the ciliary ganglion had been divided.

In the superior orbital fissure. At this site injury to the third nerve is associated with injuries to the other nerves that go through the fissure. As a result there is total ophthalmoplegia with loss of sensation in the domain of the first division of the trigeminal nerve and a dilated pupil. If there is an associated proptosis, hemorrhage within the orbit is a frequent cause of the proptosis. In such cases early recovery of the ability to move the eye is proof that the nerve block has been physiologic or that the ophthalmoplegia has been due to injury to the muscles. The syndrome of the superior orbital fissure often is associated with reduced vision in the homolateral eye in which instance it is referred to as the syndrome of the apex of the orbit; that is, there is visual loss in addition to ophthalmoplegia.

Within the cranial cavity. In our experience the intracranial portion of the third nerve is rarely injured in fractures of the skull unless the fracture extends into the orbit. Intracranial injuries of this nerve are much less frequent than of the seventh nerve. The third nerve may be injured in the cavernous sinus but in a majority of these cases the outcome is quickly fatal, due to hemorrhage.

Injury to the third nerve nucleus in the brain stem. Nuclear injury almost invariably results in bilateral ocular palsies because many fibers are crossed (medial rectus, inferior rectus, inferior oblique). A complete third-nerve paralysis which is strictly homolateral plus palsies of one or more muscles supplied by the third nerve in the contralateral eye suggests nuclear damage. Third-nerve paralysis and opposite-sided hemiplegia (Weber's syndrome) is observed infrequently.

Injuries to the fourth nerve

Isolated injuries to the fourth nerve in its intracranial portion are infrequent. More frequently the nerve is injured within the orbit. There is diplopia which is increased on looking down and to the side opposite the injury. Occasionally the trochlea is displaced from its attachment. Since only one muscle, the superior oblique, is innervated by this nerve, when regeneration occurs the result is quite satisfactory which is in distinct contrast to regeneration of the third nerve where "misdirection" occurs with regularity.

Injuries to the fifth nerve

This nerve is rarely injured intracranially. Due to the configuration of the skull, few fractures pass through Meckel's cave and, since the root is situated deep, direct injury is even more uncommon.

Occasionally one or another branch may be interrupted. This is especially true of the motor division which is not infrequently injured in jaw fractures. If the first branch is injured, the eye must be protected because corneal involvement may occur within a matter of hours (neuroparalytic keratitis). A more frequent lesion is injury to the infra- or supraorbital nerves which are severed when the bones of the face are fractured.

Regeneration of the peripheral portion of the nerve may be anticipated if the root and

ganglion are intact. Rarely, changes occur which produce the typical pain of tic douloureux in the injured portion of the nerve. When this happens it may be sufficiently severe to require section of the sensory root.

The motor root is injured infrequently. We have not seen any such cases. In common with other motor nerves, regeneration may be anticipated if the root is intact.

Injuries to the sixth nerve

Isolated paralysis of the abducens nerve occurs relatively infrequently as a result of trauma, although it would be anticipated to occur in many cases with fracture of the base of the skull. However, such a paralysis may be observed when there is no evidence of fracture of the base as we have recently observed in an individual who exhibited rhinorrhea and bilateral otorrhea; there was no demonstrable fracture that would account for the sixth-nerve paralysis which was present.

Although unilateral abducens paralysis is not a common sign in cases of head trauma, and bilateral paralysis as a direct result of such trauma must be extremely unusual, palsy of the abducens nerves develops in occasional instances and must be attributed to increased intracranial pressure. Such palsies, which are usually bilateral and tend to increase, develop several hours after the injury—in contrast to those cases in which paralysis is a direct and immediate result of injury.

It is common knowledge that sixth-nerve palsies are frequently the result of increased intracranial pressure associated with intracranial tumor. Why the nerve is injured relatively infrequently in cases of trauma is not clear. It has been suggested in the instance of increased intracranial pressure associated with cerebral tumor that the long course of the nerve along the base of the skull makes it particularly vulnerable to pressure. Perhaps there is sufficient "slack" to permit it to escape direct injury, and this may apply also to the relative infrequency of third-and fourth-nerve injuries.

In cases in which a pronounced sixth-nerve paralysis appears to be present, the examiner must recall the possibility that it may be a long-standing internal strabismus. The relatives should be questioned in order to eliminate this as a possibility.

Injuries to the seventh nerve

This nerve is injured in many cases of trauma to the head. Many patients exhibit seventh-nerve paralysis as an isolated evidence of injury. Rather often paralysis of the seventh and eighth nerves are seen together.

Paralysis of the seventh nerve which develops immediately as a result of trauma is peripheral in type and as a rule is complete. In such cases, there is immobility of the entire side of the face and forehead, inability to approximate the eyelids (the eye is open), and, on effort to close the eye, the eyeball usually turns upward (Bell's phenomenon).

Central-type facial paralysis also may be observed. With facial paralysis of the central type there is immobility of the lower half of the face. Because the upper part of the face, the eyelids, and the forehead receive innervation from the motor cortex of both sides, the movements of these structures is slightly affected, if at all.

With suprasegmental facial palsy, emotional stimuli produce normal or near-normal facial responses because such responses are not dependent upon the cortex, which is responsible for willed movements.

It is rarely difficult to differentiate the types, but occasionally the central type produces immobility of the entire half of the face and forehead for a short time (a day or two). Usually, even in an unconscious patient, one can tell the difference by the tone of the facial muscles and in a central-type paralysis, by the forehead wrinkling not being completely smoothed out.

Injury to the facial nerve is most often produced by a fracture coming down from the temporal region, crossing the middle ear,

and producing a longitudinal fracture along the petrous pyramid. If the ear drum is ruptured, blood escapes from the external auditory canal and, if the dura is torn at the same time, there will be a mixture of blood and cerebrospinal fluid. Not infrequently the tympanum remains intact but blood can often be seen behind the drum. All these cases will show diminution in hearing, but it requires considerable time and coöperation before one can distinguish between middle- and inner-ear deafness.

Depending on the site of the trauma to the nerve, taste may or may not be lost. The incidence of taste loss following head injuries has not been extensively studied and is frequently not tested. Again, considerable coöperation on the part of the patient is required.

The small amount of trauma required to crack the temporal bone and produce a facial paralysis is often surprising. When both the seventh and eighth nerves are severed simultaneously (due to transverse fractures of the pyramid), the trauma is more violent, and death often occurs.

Since the eye often becomes inflamed and irritated following the loss of blinking, it should be carefully watched during convalescence. If the fifth and seventh nerves are both damaged, a tarsorrhaphy should be done at once.

Prognosis for return of function should be guarded. Regeneration may make its appearance up to 6 to 8 months after injury. Not infrequently one sees the mass movement phenomena, and the syndrome of "crocodile tears."

If a facial paralysis is found when the patient is first seen following head injury, the physician should be on his guard to detect a preëxistent Bell's palsy. Usually there will be no sign of blood in the ear canals or behind the drum. If the patient is conscious or if close relatives are at hand, an appropriate history may be obtained. An eye exhibiting signs of chronic conjunctivitis on the same side as the paralysis almost always points to preëxisting facial paralysis. This can be detected in an unconscious patient.

The onset of facial paralysis may be delayed for several days after injury. There is development of a generalized weakness of the side of the face followed by complete paralysis within 48 hours. Conduction in the nerve probably is interrupted by local edema or hemorrhage within the bony canal. Most of these cases recover spontaneously within a few weeks. Some otologists recommend decompression of the nerve. We have no experience in this procedure.

Injuries to the eighth nerve

This nerve is probably even more frequently involved than the seventh nerve. Either the auditory or the vestibular portion may be affected separately, or jointly, or in association with the facial nerve.

Deafness is rarely bilateral. Nerve lesions may be difficult to separate from middle-ear injuries. Hearing loss due to nerve injury is permanent.

Fracture through the cochlea is usually part of a crack fracture coming down from the temporal bone and extending longitudinally along the petrous process. The fracture may be only microscopic so that a negative X-ray film means little.

Unless the injury produces deafness in the affected ear, the exact amount of damage caused by the trauma is difficult to determine. An audiogram has little value unless a record taken before the injury is available. It is because of this that so little has been written about partial losses of hearing due to injuries at the base of the brain.

Another frequent type of injury to the seventh and eighth nerves is produced by a transverse fracture through the pyramids. This often involves both divisions of the eighth nerve, as well as the seventh. Fracture in this region is produced by a severe injury and is frequently fatal.

Evans and Courville[30] have presented evi-

dence to show that the nerves may be sheared off at the porus acousticus due to a twisting of the brain. They feel that this is a common occurrence, and reason that the intracranial portion of the nerves are supported only by glial tissue, which is very soft, while the peripheral portions of the nerve have the usual neurolemma sheaths that impart considerable strength to the nerve.

Fractures through the semicircular canals may produce a train of symptoms identical with that of acute labyrinthitis or Ménière's disease. This may or may not be in association with a facial palsy and deafness. These patients are violently dizzy, complain of diplopia, and are nauseated and vomit. The vertigo may cause staggering or inability to walk. A marked nystagmus is present, and wild, uncoördinated movements of the eyes occur in some cases.

It is essential to differentiate the vomiting and eye movements from similar symptoms due to increased intracranial pressure. The symptoms may last for days. They probably are present because of abnormal stimuli to the end-organs in the canals, and these stimuli persist until degeneration has progressed to the ganglion cells. Dizziness and unsteadiness may persist for months, but the vertigo rarely lasts more than 2 to 3 days. Occasionally Ménièrelike attacks persist and an intracranial section of the vestibular nerve has been required.

Carefully projected X-ray studies of the skull may demonstrate the fracture through the semicircular canals. In comparison with injuries to the auditory nerve, the vestibular portion is rarely damaged. We have seen three instances in several hundred head injuries.

Injuries to the Ninth, Tenth, Eleventh, and Twelfth Nerves

Injuries to each of these nerves have been reported but they occur with extreme infrequency. There are probably several reasons for this:

a. Injuries to the brain stem in this area are often quickly fatal.

b. Difficulty is experienced in testing the function of these nerves in uncoöperative and unconscious patients.

c. Thickness of the occipital bone aids in diverting fractures from the jugular and hypoglossal foramina.

(*To be concluded*)

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Ophthalmic miniature

Of the means for reducing inflammation, abstraction of blood is most powerful. Blood is the material by which the increased action of the part is maintained. . . . If we could completely command the supply of blood, the increased action might be effectively controlled or arrested. In comparison with the loss of blood, all other means are of minor importance in lessening the local disorder and quieting the general disturbance.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

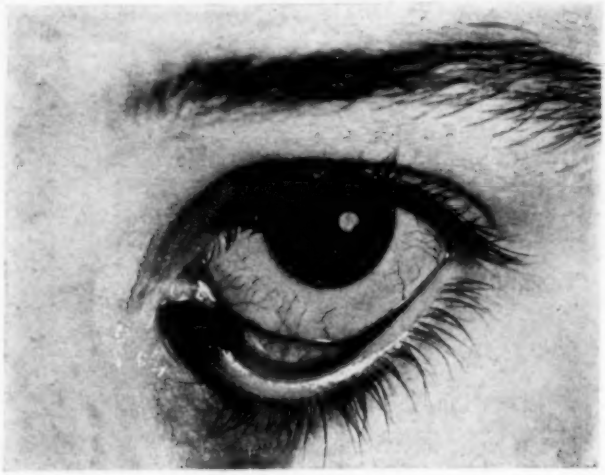

FIGURE 1

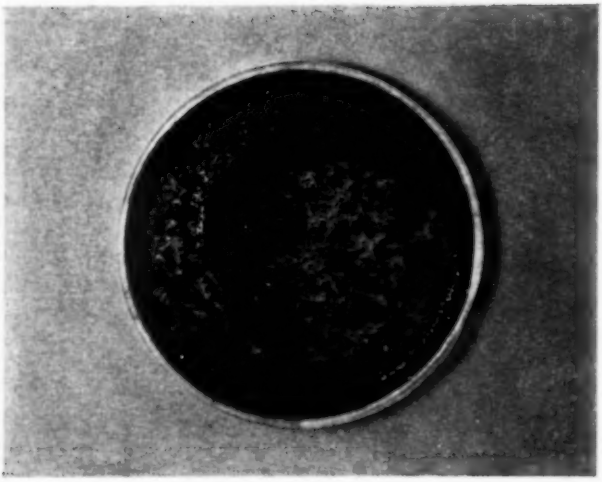

FIGURE 2

FIGS. 1 AND 2 (DONAHUE). (FIG. 1) FUNGUS LESION (ASPERGILLUS NIGER) INVOLVING THE LOWER PUNCTUM, INFERIOR CANALICULUS, AND PALPEBRAL CONJUNCTIVA. (FIG. 2) PLATE CULTURE OF SABOURAUD'S MEDIA DEMONSTRATING GROWTH OF ASPERGILLUS NIGER SPORES.

UNUSUAL MYCOTIC INFECTION OF THE LACRIMAL CANALICULI AND CONJUNCTIVA*

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The lacrimal gland and its drainage apparatus may be subject to various pathologic abnormalities, among which are: (1) Inflammation; (2) neoplasm, largely mixed tumors involving both epithelial and connective-tissue cells; (3) cystoid dilatation of the ducts of the gland, a condition called dacryops; and (4) atrophy of the gland as in xerophthalmia.

The most common of these varying types of pathologic conditions which affect the drainage apparatus is inflammation, often times involving the lacrimal duct and sac and usually due to processes set up by pathogenic bacteria following a period of stagnation of the flow of tears resulting from partial or complete occlusion of the duct.

This abnormal entity has long been recognized and the more common organisms involved in such inflammations of the tear sac are Staphylococcus albus and aureus, Streptococcus, Pneumococcus, and various diphtheroid bacilli.

In addition to these agents, however, there occur somewhat infrequently infections of the lacrimal apparatus which may be attributable to certain types of fungi. It is to this group that I desire to add a most unusual example of infection of the palpebral conjunctiva, canaliculi, and lower punctum due to Aspergillus niger.

REPORTS IN THE LITERATURE

Various infections of the lacrimal apparatus due to fungi have been reported in the literature since the original description by von Graefe, in 1854. The most common type of abnormality described has been concretion of the canaliculi due to fungus infection, the most frequently observed being Streptothrix and Leptothrix. This type of disease involving the canaliculi solely has been widely discussed in the literature; whereas, mycotic involvement of the lacrimal sac and duct are infrequently mentioned.

Reese,[1] McLanahan,[2] Carsten,[3] de Saint-Martin,[4] Elliot,[5] A. Fazakas,[6] and Valiere-Vialeix,[9] have reported cases demonstrating mycotic concretions in the canaliculi. Talice[10] and Brinkerhoff[11] have also described such cases, while Fine and Waring[8] have reported two cases of obstruction of the nasolacrimal duct due to mycotic infection. Obstruction of the canaliculi and sac due to involvement by Aspergillus niger has not been previously described in the literature.

In 1934, S. Fazakas[7] reported the results of a study to determine the flora which occur in normal and diseased eyes from the point of view of the incidence of fungi; he found that, from cultures taken from the conjunctiva, cornea, lid margins, and lacrimal passages, the most frequently recovered fungi were Penicillium, Torula, Alternaria, Schizosacchromyces hominis, Haplographium, and Aspergillus in that order.

In examining case reports, however, one cannot always conclude that the sole cause of lacrimal-duct obstruction was entirely mycotic in nature; very probably bacterial infection also played a part in producing many of these conditions.

In the case herein described, it seems to me that, from both clinical examination of the lacrimal apparatus prior to treatment and from laboratory studies of the material obtained after surgical removal of the obstructing tissue, the etiologic factor in this case was completely mycotic in character.

Abnormalities of the eye due to fungus

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infections occur in this climate infrequently, although the occurrence and distribution of fungi is enormous. Everywhere that there is organic material, earth, or plant life, there may exist fungus growth and their nomenclature, it seems to me, is in a chaotic state. There are more than 600 various types of penicillin alone with correspondingly variegated titles!

Description of Aspergillus

The fungus mold, Aspergillus, is a similar agent of infection to the mold penicillin. It is composed of 66 different types which may be differentiated from one another by means of morphology and growth characteristics in ordinary media. It is found in all parts of the world, especially in France, Germany, Italy, Australia, and North and South America; it is extremely prevalent in soil, dried vegetable matter, hay, and grain and it thrives on a small amount of moisture. In contrast to penicillin, it must have a high optimum temperature and accordingly predominates in the tropics, whereas penicillin predominates in the northern climates.

This fungus is an important cause of spoilage of preserves, jellies, bread, and meats; there are only one or two species which are pathogenic to man, although many species are pathogenic to birds, insects, domestic animals, and plants.

Aspergillus fumigatus is pathogenic especially to birds, and is found commonly in chickens, pigeons, and ducks, where it is a cause of some diseases which are of economic importance. It produces the so-called "brooder pneumonia" in epidemic form in chicks which can be traced to the ingestion of moldy grain and to moldy nesting material. Cattle, sheep, and horses may also develop aspergillosis of the lungs, the spores being inhaled from contaminated hay or grain.

Aspergillus fumigatus and Aspergillus niger are pathogenic to man, producing inflammatory granulomatous lesions of the skin, external ear, nasal sinuses, orbit, bronchi, lungs, and occasionally in the bones and meninges.

In the tropics, man is also a victim of a form of infection which produces splenomegaly.

Adults are affected more commonly than children, males more frequently than females. Infection occurs most often in those exposed to fungus spores as: (1) Bird feeders who place grain in the mouth to moisten it and incidentally inhale clouds of spores; (2) fur cleaners who use rye flour containing spores; and (3) agricultural workers exposed to dust from threshing machines.

Aspergillus niger

One of the more common species of the Aspergillus family is Aspergillus niger, which is easily recognized morphologically by high and widely spaced conidiophores terminating in high, black globular sporeheads. From these sporeheads lie radially disposed primary sterigmas, each of which bears secondary sterigmas; the conidia are black or dark brown and spiny. This species is of some importance in the spoilage of foodstuffs and grows by preference in substances rich in sugar and of an acid reaction.

In regard to its effect upon the eye, the literature reveals that abnormalities may be produced in the lid margins, conjunctiva, cornea, iris, and vitreous. What happens pathologically has been most widely studied in the cornea, although entire eyes have been examined by Schirmer, Nobbe, Buchanan, and others.

The usual infection of the cornea by the Aspergillus produces a rather typical clinical picture characterized by the development of a gray ulcerative necrotic area with a dull, dry surface surrounded by a yellow line of demarcation, running a very slow course and associated with hypopyon.

This rare infection is carried to the eye by foreign bodies associated with earth and portions of plants to which are attached the spores of the fungus. The first case of this

type was reported by Leber, in 1879, who reproduced the condition experimentally in a rabbit's cornea.

Description of eye infection

Following the injury to the epithelium by a foreign body, a gray cloudiness develops with a dull, dry, crumbly surface around which develops a very sharply defined line of demarcation, usually yellowish in color. Very slowly, this line deepens into a gutter and finally the infiltrated areas are sloughed off, revealing an infiltrated ulcer.

The active stage is associated with iritis and the formation of an hypopyon but, after the sequestrum is thrown off, healing tends to follow. Perforation is rare, but can occur. The entire process is very slow and gradual and usually symptoms are slight, although occasionally there may be considerable pain. Usually the lesion is as described but rarely it takes on a less serious form and is not central but near the limbus.

Pathologic examination shows advanced necrosis with a lesion permeated by a densely felted mycelium which forms a network of fibers. The area around the slough is densely infiltrated by a typical infiltration ring of leukocytes surrounding the lesion, while the iris and ciliary body are infiltrated with round cells. It would appear that the toxins of the fungus, when concentrated locally, cause complete necrosis, and, diffusing outward, cause chemotactically a widespread migration of cells from the entire anterior segment of the globe.

One result is sufficient concentration of leukocytes around the lesion to cause a complete and sharp line of demarcation by their histolytic ferments; another, the formation of hypopyon. Only rarely does the fungus penetrate into the inner eye and invade the vitreous.

Previous incidence of an infection of the conjunctiva and canaliculi due to Aspergillus niger was not discovered in the available literature, although Rosenvold,[13] in 1942, reported two cases of dacryocystitis and blepharitis which he states were caused by this fungus. In one case, the source of infection was in the nose; the other was attributed to the ear.

Report of case

This is the case of a 12-year-old white schoolgirl who consulted me because of epiphora and discoloration of the inner aspect of the lower lid of the left eye which had been present for several weeks.

This child had always been in good health, and general physical examination revealed nothing abnormal. Examination of the ears, nose, and sinuses by an otolaryngologist showed no evidence of disease.

Vision in the right eye was 20/20, and this eye was entirely normal. Vision in the left eye was 20/20. The upper lid was normal. Upon the lower lid in the region of the punctum, there was a discoid slightly elevated area, about 1 cm. in diameter, of brown-black color which was situated underneath the palpebral conjunctiva and which could be completely seen only by eversion of the lid.

The upper punctum was normal. The lower punctum was completely occluded with a black substance which resembled the tip of a lead pencil. Pressure upon the lacrimal sac produced no discharge. There was no preauricular glandular swelling. Irrigation through the upper punctum was attempted but no fluid passed into the nose. This lesion was unique and perplexing in appearance and melanoma or angioma of the conjunctiva were considered possibilities.

A very tiny incision was made under local anesthesia in the black substance located in the lower punctum and following this procedure, pressure was exerted in the tear-sac region. A sticky, tenacious, molasseslike fluid was expressed, with complete disappearance of the brownish-black discoloration of the conjunctiva. Fluid was then easily irrigated through the canaliculi and passed easily into the nose. The material expressed and the nasal washings were cultured following this

procedure. The patient has been completely relieved of epiphora and no further symptoms have occurred.

Laboratory studies

The black viscid material together with the nasal washings were submitted to Miss A. Mangiaricine, bacteriologist at the Massachusetts Eye and Ear Infirmary, and a portion was inoculated upon two Petri dishes of Sabouraud's dextrose agar.

Following a period of incubation, the Sabouraud's agar plate revealed a growth of typical Aspergillus niger fungi whose morphologic characteristics were completely demonstrated. These colonies are fast growing and first appear as white filamentous growths upon the surface of the medium, but quickly become dark green and black in color as spores are produced.

The diagnosis is based upon finding mycelian fragments and numerous spores upon direct examination and upon obtaining a culture showing the typical morphology of Aspergillus Niger, with conidiophores and spore changes characteristic of this fungus.

I believe that this very unusual brownish-black lesion involving the lower punctum, canaliculi, and conjunctiva was caused by the formation of a cast resulting from infection by the Aspergillus niger fungus. This fungus produced mechanical formation of the cast which in turn produced occlusion of the lower punctum; extension of the infection to the palpebral conjunctiva occurred secondarily.

Summary

A case of mycotic obstruction of the lacrimal canaliculi with involvement of the palpebral conjunctiva is described with identification of the fungus Aspergillus niger as the etiologic agent. Recovery from symptoms was immediate following extrusion of a tenacious, black, viscid substance after incision of the lower punctum and pressure upon the tear sac. Prior incidence of such fungus infection has not been described in the available literature.

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ALTITUDINAL HEMIANOPIA DURING STREPTOMYCIN THERAPY*

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Horizontal hemianopia and especially the altitudinal type is relatively uncommon. It has previously been reported in the literature as attributable to embolism of an inferior retinal artery,[1, 2, 10] cachexia during anemia,[3] gastrointestinal hemorrhage,[4] multiple sclerosis,[5] aneurysm of the ophthalmic artery,[6] hemorrhagic lesions located in the calcarine region,[7] retinal arteritis,[8] subpial hematoma over the occipital lobe following occipital injury,[9] calcification of the internal carotid artery,[10] and air embolism of retinal arteries during collapse therapy.[11]

This incident has not, however, been reported as occurring during streptomycin treatment. Furthermore, a diligent search of the literature has failed to reveal a single case of a visual-field defect arising during the administration of this antibiotic. Parenteral streptomycin therapy has been used at Fitzsimons General Hospital on more than 500 patients with tuberculosis since October, 1945. In this group one case with a visual-field defect was noted. This is a presentation of that case.

CASE REPORT

The patient, a 31-year-old white woman with pulmonary tuberculosis, came to the Eye Clinic at Fitzsimons General Hospital on October 20, 1947, complaining of sudden loss of vision in the upper field of the right eye of two days' duration. She had been on streptomycin therapy since August 28, 1947.

Her past history revealed that in July, 1946, a diagnosis of pulmonary tuberculosis was made. Her sputum was positive. X-ray examination showed minimal infiltration of the right lower lobe. Cavitation was not found. Right phrenemphraxis was performed and collapse therapy was begun. The latter consisted of 12 treatments of pneumoperitoneum up to the time of the hemianopia, 500 to 800 cc. of air being injected into the peritoneal cavity each time, the last injection being four days before the onset of her visual symptoms.

On August 28, 1947, parenteral streptomycin was begun, using 1 gm. daily in 4 divided doses.[15] On October 18, 1947, 50 days after streptomycin had been started, the patient had the sudden loss of the right superior field, preceded by a severe occiptal headache. Streptomycin was discontinued on October 20, 1947.

The first examination, on October 20, 1947, revealed the visual acuity of the right eye to be 20/30, correctible to 20/20; left eye, 20/20. Pupils were equal and regular and reacted well to light and accommodation. There was no diplopia. Slitlamp examination was negative. Ophthalmoscopic examination of the right eye revealed the media to be clear. The disc, retinal veins, macula, and retinal periphery were normal. The retinal arteries were generally attenuated, the superior vessels slightly, the inferior vessels more markedly. The patient could not see the ophthalmoscopic beam with the inferior retina. The left eye was normal throughout; no constriction of the arteries was noted.

Visual-field studies of the right eye showed an absolute altitudinal defect to the bright light of an ophthalmoscope bulb at 1,000 mm., through the midline, sparing the macula. There was an area of relative scotoma in the entire lower half of this field. White 3/330, and white 3/1,000, were barely seen. With colored test objects the right eye could recognize blue, 10/1,000, within 10 degrees of the macula inferiorly.

* From Fitzsimons General Hospital, Denver.

There was neither red nor green perception. The left eye showed normal fields.

Therapy consisted of 50 mg. sodium nitrite, intravenously (Nitroscleran) stat.

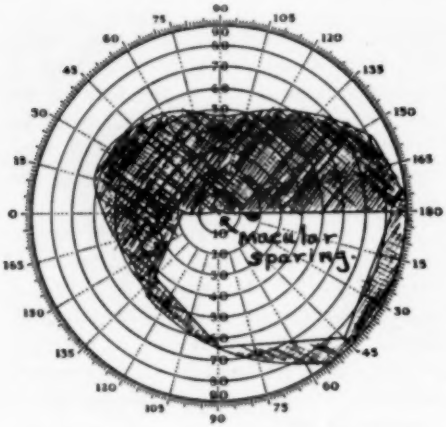

Fig. 1 (Schultz). *Peripheral field.* October 20, 1947. White, 3/330. Visual acuity, 20/30.

and 50 mg. (q3h) intramuscularly, for 24 hours. The eye was massaged hourly. The following day, more energetic therapy seemed to be indicated since the vascular attenuation and field defect persisted. The ciliary ganglion was anesthetized by retrobulbar injection of 2 cc. of 2-percent novocaine solution. A paracentesis of the anterior chamber was performed and at the same time 100 mg. sodium nitrite was injected intravenously. Dicumarol was started, keeping the prothrombin time at 40 to 50 percent of normal, and 60 mg. rutin was given once daily. The latter two drugs were given on the premise that a thrombus or embolus might be present at the bifurcation of the central retinal artery, although none could be seen with the giant ophthalmoscope.[20-22]

Course. Under this regimen the field defect improved and recognition of colors returned. On October 23, 1947, three days after the onset of symptoms, ophthalmoscopic examination of the nervehead of the right eye disclosed about one-diopter elevation, probably due to hypotony following paracentesis. Field study disclosed a slight uniform enlargement of the blindspot.

Visual acuity remained at 20/30 in the right eye, correctible to 20/20 until November 7, 1947, 19 days later, when visual acuity in the right eye was found to be 20/100, uncorrectible. No new ophthalmoscopic findings were present.

Previous therapy, consisting of sodium nitrite, dicumarol and rutin, was continued. Four ampules of amyl nitrite, (0.3 cc. each) were inhaled successively, immediately improving vision to 20/70 in the right eye. This amyl-nitrite therapy was repeated on alternate days for six times and, in two weeks, visual acuity in the right eye was 20/30 uncorrected. The final examination on

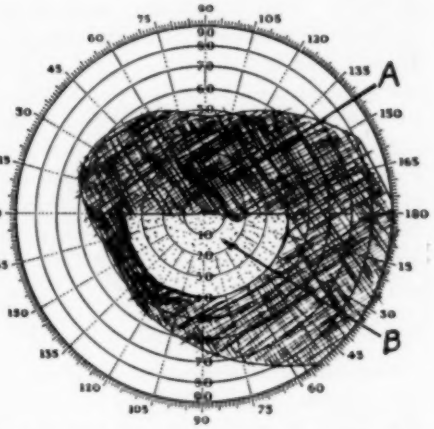

Fig. 2 (Schultz). *Central field.* October 20, 1947. White, 3/1,000. (A) Absolute scotoma. (B) Relative scotoma for white. No color perception. Visual acuity, 20/30.

January 13, 1948, showed visual acuity of the right eye to be 20/30, correctible to 20/20; left eye, 20/20, uncorrected.

Final ophthalmoscopic examination of the right eye showed the media to be clear. The disc was of normal size, shape, and color except for slight temporal pallor, and the

previous elevation was no longer present. The arteries of the superior retina were nearly normal in caliber, and the A-V ratio was 2:3. The inferior retinal arteries showed generalized attenuation but were not as constricted as at the time of the first examination. The A-V ratio was 1:3. The macula and peripheral fundus were normal. The left eye was entirely normal.

The visual field studies of the right eye revealed a normal peripheral field for white 3/330. The central field for white, 3/1,000, showed a normal blindspot but the presence of a 2 by 5-degree, vertical relative scotoma just nasal to the fixation point. This was a remnant of the previous superior paracentral scotoma. The color fields for red, green, blue, 10/1,000 were normal.

The patient has had no recurrences as of January 1, 1949. The drug therapy was discontinued on November 20, 1947. Streptomycin has not been given since October 20, 1947.

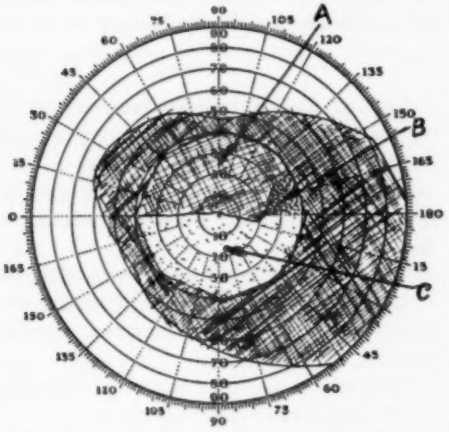

Fig. 3 (Schultz). *Central field.* October 22, 1947. White, 3/1,000. (A) Perceives hand movements for the first time. (B) Relative scotoma. (C) Red-green blind; normal for white and blue. Visual acuity, 20/30.

Discussion

In scrutinizing the reports on streptomycin toxicity[12-16] I have found no mention of visual-field defects occurring during its use.

If it is considered that this visual-field defect was caused by a thrombus or embolus of the inferior retinal arterial trunk producing incomplete obstruction, then what grounds are there to indict streptomycin as the precipitating cause?

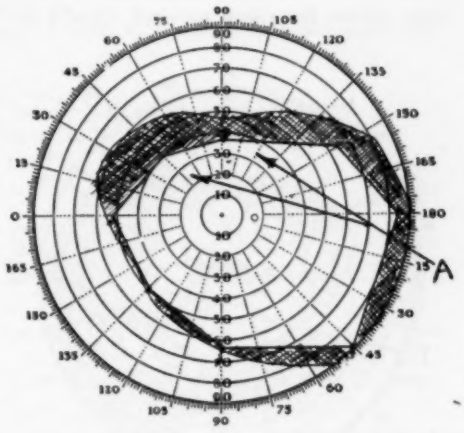

Fig. 4. (Schultz). *Peripheral field.* October 27, 1947. White, 3/330. (A) Partial recovery of superior field. Visual acuity, 20/30.

Moldavsky and others[23] have shown that in a series of human subjects receiving parenteral injections of penicillin, the clotting time was much shorter after, than before, the injection of the antibiotic. Macht[17] in his work on laboratory animals has concurred with Moldavsky's findings and, furthermore, has shown that streptomycin likewise exhibits similar thromboplastic properties. His tabulations indicate about 60-percent acceleration of the clotting time of whole blood one hour after injection of streptomycin.

Pertinent is Frada's[18] report of four patients whose embolic accidents he attributed to penicillin which increased the coagulability of the blood. Thus, it is conceivable that after 50 days of streptomycin therapy our patient may have had an increase in coagulation time producing thrombosis and possibly

an embolus. Unfortunately, coagulation time determination was not done.

In considering the possibility of an air embolus,[11, 19] it is to be remembered that the patient received pneumoperitoneum four days before the visual accident. Should the

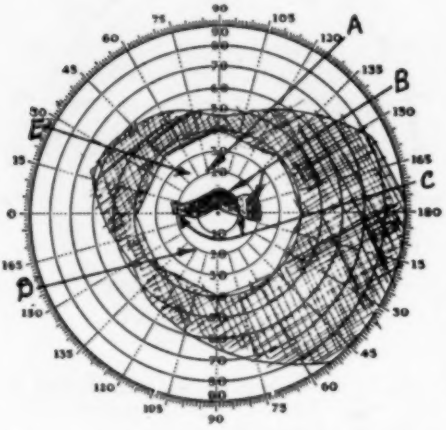

Fig. 5 (Schultz). *Central field.* November 4, 1947. (A) Recovery of full superior central field. (B) Absolute paracentral scotomas—white, 3/1,000. (C) Relative scotomas—white, 3/1,000. (D). Blue, 10/1,000; poor red; no green. (E) Blue, 10/1,000; no red; no green. Visual acuity, 20/30.

air have made its way into the venous circulation, its terminus would have been the lungs. Furthermore, it is believed that the effects of air embolus usually occur immediately or within 24 hours.[11]

It has been found that with large doses of streptomycin, toxic reactions are more frequent than with small doses. In this case only 1 gm. in four divided doses was given daily for 50 days. This is considered a safe dosage.[18]

The patient had normal laboratory reports and skull X-ray studies. There was no evidence of multiple sclerosis, brain hemorrhage, nor retinal arteritis, and no history of head injury.

Angiospasm[19] is a possible but not probable cause of the field defect. There was no evidence of vasomotor instability in this patient. She has never had migraine headaches although, just prior to the onset of the visual complaint, this patient experienced for the first time a severe occipital headache which has not recurred. She had no menstrual or ovarian disturbances. On ophthalmoscopic examination following intensive vasodilator therapy, the arterial attenuation and field defect persisted. If angiospasm had been the primary cause of the hemianopia, the vascular attenuation should have diminished with this therapy.

Summary

Altitudinal hemianopia occurred in a tuberculous patient during streptomycin therapy.

The most probable causes are cited: streptomycin toxicity, air embolus, and angiospasm.

Therapy was based on the premise that a thrombus or embolus produced partial obstruction in an inferior retinal arterial trunk.

Complete visual recovery was obtained.

119 East Grand River Street.

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THE ROLE OF THE SHAHAN THERMOPHORE IN OPHTHALMIC THERAPEUTICS*

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The apparatus, now known as the Shahan thermophore, was invented by Dr. W. E. Shahan in an effort to place the local applications of heat to the various lesions of the eye upon a more scientific basis. His first paper concerning this instrument appeared in 1916.[1]

The thermophore then, as now, consisted essentially of a brass tube, into one end of which could be slipped solid brass applicators with contact surfaces of various sizes. A thermometer was fastened into the other end of the tube in such a way as to bring the bulb into close approximation with the applicator. The temperature was regulated by a resistance coil wrapped around this tube and connected with the electric circuit through a thermal couple, controlled by a thumbscrew conveniently placed on the side of the instrument. Thus, the temperature of the applicator was recorded and could be set at any desired level and maintained there with only the slightest fluctuations.

The original objective of these investigations was the determination of the thermal death point of the pneumococcus in corneal ulcers. Since then, similar statistics concerning the heat resistance, coupled with the length of exposure, of the various tissues of the eye, and many of the organisms invading them, have been determined with great accuracy.

Improvement in design

It is, therefore, surprising that this valuable instrument should have fallen into almost complete neglect. A number of factors appear to be responsible. At first, following its introduction, there was much enthusiasm over its use, and many papers concerning results obtained with it appeared in the literature. But, as the novelty waned and the field appeared to have been pretty well covered, less and less was written concerning it.

Furthermore, as in the case of every new agent, failures occurred. These were, in a large part, due to improper technique, or to use of the apparatus in cases involving lesions with which it was not adapted to cope.

Added to such causes for neglect, was an unfortunate lack of accuracy in the early instruments. The actual temperature of the applicator and that indicated by the thermometer frequently differed by as much as several degrees. Still another factor has been

*From the Department of Ophthalmology, Washington University School of Medicine. Presented at the III Pan-American Congress of Ophthalmology, Havana, January, 1948.

the inability of the manufacturer to produce the instrument during the war years. As now made,[2] the Shahan thermophore has been considerably altered in design. A new type of mechanical thermometer and a longer applicator have been adopted, resulting in highly accurate temperature recordings.

In addition, Dr. Shahan[3] has developed a simple method by which the accuracy of each individual instrument can easily be checked and, if necessary, a table of corrections constructed. This was done by observing the melting point of finely ground crystals of a number of substances dusted over the applicator and comparing the melting points, as recorded by the instrument, with those previously determined by standard methods.

For this purpose, Dr. Shahan selected metals whose melting points were distributed at intervals from 118.5°F. to 173.5°F. By careful investigations, he discovered that the accepted melting points were usually incorrect. Numerous observations proved that thymol crystals melted at 118.5°F., palmitic acid at 167.5°F., and acetamide at 173.5°F. Variations in the individual instrument from these temperatures obviously determine the table of corrections for that instrument.

It would appear, therefore, that the two mechanical obstacles have been overcome, thus paving the way for a resumption of the study of this device. It seems fitting that its uses and abuses should once more be discussed and clarified, in order that it may be used, and used properly, where indicated, and not relied upon where injury or the spread of malignancy may result.

Temperatures and time of exposure

When the thermophore was first introduced, there was a tendency to extend the time of the application from one minute to as much as 10 minutes. Certain experiments of the inventor showed that it required 2 minutes to raise the temperature of the anterior chamber up to that indicated by the instrument. On this account, 2 minutes were selected as the proper time to carry out effective treatment of lesions of the deeper structures *not* in immediate contact with the applicator. For all other lesions, one minute has been considered best, and the temperatures regulated accordingly.

In the paper previously quoted,[4] Dr. Shahan reviews the temperatures which should be used for the various results desired. He states that, "for moderate stimulation of indolent, noninfected ulcers, where destruction of corneal epithelium is not desired, a temperature of from 115°F. to 125°F. is employed. For active stimulation of indolent ulcers, such as form on old scars, where temporary destruction of corneal epithelium *is* permissible, but not injury to Bowman's membrane, a temperature of from 130°F. to 135°F. is applied for one minute." He goes on to state that, "this temperature is also useful in cases in which the epithelium is continuously breaking or desquamating."

It has been shown that 140°F. to 145°F. is above the death point of most succulent corneal, conjunctival, and dermal neoplasms, and below that of normal corneal and conjunctival tissues, except the corneal epithelium, which rapidly regenerates.

Shahan[5] states that "Epitheliomata (that is squamous carcinomata), papillomata, certain fatty growths, and pigmented or nonpigmented naevi of the cornea and conjunctiva are effectively destroyed by applications of from one to two minutes at this temperature."

The entire abnormal growth may be eliminated by one or several overlapping applications at the same time, or by a number of applications carried out from time to time. A warning note, however, is in order at this point, that, while incomplete destruction at the first application does not necessarily result in the spread of malignant lesions, great care must be exercised to make sure that eventually the entire lesion has been destroyed.

In this connection, there is some difference of opinion as to whether malignant growths should be excised surgically where possible, and then treated by application of the thermophore, or should be treated without previous surgical intervention. It is well known that incomplete surgical removal can accelerate metastasis. But it is argued that this tendency is arrested by the subsequent application of the thermophore. Many, including Dr. Shahan, feel that, as a rule, the entire procedure can be carried out in a more satisfactory manner and with less danger of metastasis by, first, the thorough use of the instrument alone, followed by surgery where necessary.

Temperatures of 152°F. to 158°F. destroy not only the epithelium, but also the cells and structures of the parenchyma of the cornea, and result in permanent clouding of this tissue. The conditions for which these higher temperatures are used, however, are such as would otherwise result in complete destruction of far greater areas than those injured by the application, and might, in many instances, result in loss of the entire globe itself. The pneumococci, for instance, which lie within the substantia propria, sometimes with unbroken, overlying Bowman's membrane and epithelium, and which produce hypopyon, keratitis and, at other times, serpiginous ulcers of the cornea, necessitate these higher temperatures for a period of one minute in order to destroy the deep-lying organisms; the deeper the involvement, the higher the temperature and the longer the exposure required.

Reaction of tissues

The subsequent reaction of the tissues to this form of therapy is most interesting and an understanding of its various phases is of great importance. Undoubtedly, a lack of such information, coupled with improper subsequent management, has done much to discredit this form of treatment. It is normal that some pain should be experienced for an hour or two, but later be conspicuous by its absence.

Little change will be noted in the lesion during the first 24 hours. In the case of corneal ulcer, it appears at this time about as extensive as before treatment, but will have become gray instead of yellow. After another 24 hours, a succulent, soft exudate may heap up over the ulcerated area. This may be somewhat alarming in appearance, but resorption usually follows rapidly.

During this period of recuperation, no other treatment, except possibly the instillation of atropine and a protective dressing, is required. If, however, the yellowish cast should reappear in the lesion, further applications are indicated.

Proper method of use

The proper method of using the instrument is also of the greatest importance. The applications should be firm and continuous. Interrupting the procedure to inspect the result is not permissible, and even though the total time of the application is considerably extended, the effect produced is not the same.

If possible, the applicator should be sufficiently large to cover the entire infiltrated area, which, in the case of pneumococcus ulcers, would include not only the ulcer itself, but the undermined portion as well. Overlapping applications are permissible, as previously stated, but are not as satisfactory as a single one. The areas treated twice by reason of the overlapping do not appear, however, to suffer on this account.

Report of a case

An instance of a satisfactory outcome from such overlapping applications is that of the case of W. J., a Pullman-car porter, who was first seen by me on February 6, 1945. He reported having gotten a foreign body into his left eye 15 days previously. This was removed by a soldier travelling on his car. Four days later, when examined by

a physician, the eye was sore and inflamed, but no foreign body was found.

When first seen in our office, 12 days afterward, the vision, with glasses, was: O.D., 20/24; O.S., 20/50. Inspection showed a ring abscess of the cornea of the left eye, the ring complete but for a space of 2 mm. at the lower pole. It was about 2 mm. in width and lay approximately 1½ mm. from the limbus throughout its entire circumference. There was a dense, grayish-yellow infiltration, but nowhere did it stain with fluorescein.

Local astringents, atropine, and sedatives were given. The next day there was still no staining. Sulfadiazine was started. On the third day, the abscess began to take the stain. Six applications of the thermophore at 160°F. were made, covering the entire ulcer. The procedure was somewhat painful, despite preliminary subconjunctival injections of cocaine (5 percent) with adrenalin (1:16,000).

Two days later, the patient signed his own release and left the hospital, indignant over his treatment. But 48 hours later, having been told elsewhere that his eye must be removed, he requested that I resume his further care.

In the meantime, injections of penicillin, 20,000 units every two hours, had been instituted. These were discontinued, but local instillations of the same drug were started, along with hot compresses and atropine sufficiently often to keep the pupil well dilated. This treatment, with sulfathiazole ointment (5 percent) each night, was continued until his discharge from the hospital 13 days later.

Eventually the eye cleared so that only a very slight nebula could be made out at the site of the former abscess, and vision, with glasses, was stabilized at 20/30 where it had remained when the patient was last seen, a year after the original attack.

A similar case was reported by Dr. L. T. Post.[6] In this instance, four applications were made for one minute at 158°F.

Indications for use

Many other lesions of various types have been treated with this instrument. It has proved very useful in clearing up the small granulomas on the lid margin that remain as an aftermath of chalazia. No other treatment compares with it for this purpose. Xanthomas respond nicely to applications of one minute at 145°F.

Angiomas of lids

Angiomas of the epithelium of the lids and conjunctiva may also be treated by the same exposure. The reaction is very interesting. The first effect is a slight cloudiness in the mass of the tumor. The whorls of blood vessels became darker in color. After 24 hours, they grow very dark and irregular in caliber, widely dilated in some spots, constricted in others. Small hemorrhagic masses appear shortly afterward. The surrounding skin, or conjunctiva, is quite edematous for several days. Then, gradually, the picture clears, all reaction disappearing in from 2 to 3 weeks.

Malignant growths

Another interesting phase of thermophore therapy concerns the destruction of malignant growths. It has been noted that certain such tissues are highly susceptible when so located that direct contact with the applicator is possible.

The excellent results obtained with these tumors led Dr. L. T. Post[7] to attempt the destruction of experimentally induced sarcoma of the iris in the rat. These tumors, also known as Jansen's sarcoma, are of the spindle-celled type, which has lost the property of metastasis but has retained that of rapid growth and malignancy. Untreated, these tumors grow rapidly, so that in one week they entirely fill the eyeball, with subsequent rupture of the globe and extension throughout the orbit.

Such a tumor, 1½ mm. in surface diameter, obliterating the iris angle and ex-

tending two thirds of the way to the pupillary border, was treated at 160°F. by an applicator whose surface was just sufficiently large to cover the entire tumor. There was immediate loss of the corneal epithelium, and a cloudy swelling of the substantia propria. By the second day, chemosis and redness of the conjunctiva were evident but the epithelium was replaced. In about one week the grayish infiltration was beginning to subside and the tumor mass was seen to be much smaller. Five months later, at autopsy, only a very thin grayish infiltration remained, and the residual clouding of the cornea did not extend more than 1 mm. from the limbus.

It was found that certain of these tumors required second applications for their complete elimination and that these treatments were well borne by the ocular tissues. On the other hand, larger tumors, filling about one half the anterior chamber, required such severe treatment for their destruction that the eyes harboring them did not survive the process.

Sarcomas of iris

Investigation has shown that the human eye is more tolerant of thermophore treatment than animal eyes, wherefore it has been felt that sarcomas of the human iris might be susceptible to such treatment, but that it would be justified only where surgery was refused. One such case in the practice of Dr. William H. Luedde, an only eye with sarcoma of the iris, was so treated, and survived with useful vision for nine years.

Use in glaucoma

Dr. L. T. Post[8] has made an extensive report on the use of the thermophore, with special reference to its possible role in control of intraocular pressure in glaucoma. Forty such eyes were treated. With one or two exceptions, this investigation met with little success, although in one case the tension was held at normal for an entire year after a single treatment, with no use of miotics. In a second case, treatment was repeated once every four months for a similar length of time, during which there was no rise in tension nor loss of visual field although previously the progress had been rapid. At the end of the year, the patient was forced to leave the city, and was blind in six months, despite the routine use of miotics in the home.

Atrophy of iris

It was noticed in these two cases that definite atrophy of the iris had been produced at the point of application, from which observation it appeared that, if a hole could be made in the iris by the thermophore, there might be reason to believe that permanent reduction in tension would follow. In the development of this thesis, a large number of rabbit eyes were treated and later enucleated for microscopic examination. It was found that occasionally a hole could be developed by temperatures from 170°F. to 190°F., applied for periods of 2 to 3 minutes, but that to be sure of this result, 200°F., or higher, must be reached. With these temperatures, the destruction of other tissues of the eye was so great as to make such procedures impracticable.

Retinal detachment

Finally, the use of the thermophore in detachment of the retina must be mentioned. Dr. Shahan felt that it should be possible, using this instrument, to set up inflammatory reactions that would produce adhesions between the sclera, choroid, and retina. He and I, therefore, attempted such operations in several cases.

The conjunctiva was dissected away from the sclera and the recti muscles were severed, or drawn aside, as in the classical procedure, and the thermophore applied in numerous places. *Afterward* the sclera was incised and the subretinal fluid allowed to drain off. None of these cases, however, was permanently successful.

Dr. H. Maxwell Langdon,[9] on the other

hand, reported 5 cases operated upon by this method, the results in 4 of which were quite satisfactory. The principal difference between the procedure followed by Dr. Langdon and ourselves was that Dr. Langdon made two scleral punctures *previous* to the application of the thermophore, thus bringing the retina into closer approximation with the choroid and sclera before the applications; whereas, we made our punctures in the classical manner at close of operation.

The occurrence, since then, of a number of massive vitreous hemorrhages following such operations has discouraged further efforts along these lines, until recently, when Dr. Philip Shahan operated upon four eyes following the technique of Dr. Langdon; that is, withdrawing the subretinal fluid *before* application of the thermophore. Two of these cases have thus far, over a period of 5 and 10 months respectively, given satisfactory results.

The new model of Shahan thermophore is equipped with a special form of applicator adapted to fit closely against the sclera, quite well back toward the posterior pole of the globe. The method in the use of this is far simpler than that now in vogue, and is deserving of further study.

Summary

The Shahan thermophore is an instrument of immense value in ocular therapy, when properly used, and should be thoroughly understood by every well-informed ophthalmologist.

By means of this instrument, the first scientific study of the effects of varying degrees of heat upon the ocular tissues, and upon a number of bacteria and viruses invading them, has been made possible.

Temperatures up to 145°F., applied for one minute, do no permanent injury to normal ocular tissues, nor do they result in persistent clouding of the cornea.

Temperatures of 158°F. to 160°F. do result in permanent changes in the substantia propria of the cornea, but such temperatures are only necessary in the most severe types of lesions, such as those resulting from the action of the tubercle bacillus.

During treatment, the applicator should never be lifted, but should be in firm and constant contact with the lesion throughout the entire time indicated.

The applicator should be of sufficient size to cover the entire lesion at one time, or should be applied with slightly overlapping edges a sufficient number of times to accomplish this result.

The reactions should be thoroughly understood to avoid alarm and to enable the operator to judge correctly as to when further applications are, or are not, desirable.

Malignant growths should be treated with circumspection, and the greatest effort should be used to eliminate the initial lesion thoroughly at the first application.

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SYNKINETIC OVERACTION OF THE INFERIOR OBLIQUE MUSCLE*

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Overaction of an inferior oblique is ordinarily thought to result from a paresis of the homolateral superior oblique or of the contralateral superior rectus. The question is certainly unsettled as to which of these muscles is most frequently paralyzed. Assertions of authorities do not help to answer this question. For example, Duane,[14] White,[2] and Brown and White[1] believe that the superior rectus is the one most frequently paretic. Of 527 cases reported by White and Brown the superior oblique was paralytic in 4 percent, and the superior rectus in 96 percent. In marked contrast to this viewpoint is that of Bielschowsky[3] who believed the superior oblique to be most frequently paralytic.

Davis,[4] however, remarked that, of 88 cases which he observed, the superior oblique was paralytic in 54.5 percent; the superior rectus in 45.5 percent.

Such confusion is brought to our attention by Smith,[5] who believed that cases of paralysis of the superior oblique may be overlooked.

On the other hand, there may be other reasons for the findings of these investigators concerning hyperkinesa or hypertonia of an inferior oblique muscle. These reasons may be that the examiners have overlooked a slight paresis, have different percentages of such cases (Bielschowsky in Europe, White in the United States), or that supranuclear disturbances cause such overaction.

The situation may be better understood if we study supranuclear or central motor disturbances and consider them tentatively as causes of an overaction of the inferior oblique. Such disturbances and such synkinetic overaction at first display all the evidences of supranuclear disturbances; namely, early onset and extreme variability in deviaton, which can be influenced by such emotions as anger, fear, and excitement. Most of the younger children presenting a hypertropia display these characteristics of supranuclear neuromotor phenomena. If, however, the synkinetic overaction of the inferior oblique muscle persists over a period of several years, a contracture of this muscle tissue occurs, and the superior oblique relaxes. In cases of untreated synkinetic overaction of the inferior oblique muscle, it is difficult to determine whether a paresis of a superior oblique muscle is present or a paresis of a superior rectus of the contralateral eye exists.

In many of these cases wherein there exists synkinetic overaction of the inferior obliques and the relaxation of the superior oblique is of slight amount, a bilateral superior rectus paralysis may appear, not as a secondary complication, but as a primary actuality. It is important to stress that it is extremely difficult in such cases to differentiate between a superior rectus paralysis of the contralateral eye, a superior oblique paralysis of the ipsilateral, and an overaction of an inferior oblique resulting from a supranuclear disturbance (synkinetic overaction).

That such an overaction of the inferior oblique muscle might occur by reason of cortical or subcortical impulses was first suggested by Dr. Douglas Buchanan. I was at first incredulous concerning this possibility. I therefore began to study patients with cortical disturbances under the guidance of Dr. Buchanan. Some of these children possessed cerebrospastic hemiplegias and squint. The squint, as well as the general motor defects, was variable and was improved by rest and

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quiet. It was increased in degree by fatigue, anger, and attention to the patient's deformity.

Every oculist has observed such patients with esotropia and hypertropia. The deviation was increased during the ocular examination and the strabismus disappeared while the patient was under general anesthesia. These signs are characteristic of supranuclear or central defects which are associated with strabismus. The squint usually is of the convergent type combined with a considerable overaction of the inferior oblique muscle. The term suggested by Dr. Buchanan, in 1939, was synkinetic overaction and the process by which this overaction occurs may be called irradiation or spread of impulses.

Neurologic literature

In the neurologic literature the phenomenon of synkinesis is frequently discussed. Synkinesis may be defined as an involuntary movement taking place in a part of the body in consequence of a voluntary or reflex movement in another part.

Synkinetic movements as a result of irradiation was stressed by Wright[6] who defined the phenomenon of irradiation as impulses which do not expend themselves exclusively in their own segment or divison of the central nervous system. They tend to spread more widely to involve additional centers or regions—even to some which are regarded as being unrelated portions of the nervous system.

Likewise, Wartenberg[7] discussed synkinetic movements under the term involuntary movements which are found in cases with "Pseudo-Graefe sign," "Fuchs's sign," "Levator spasm of the upper lid," and "'See-saw movements."

Wartenberg reported a 27-year-old man who had suffered a brain injury and a complete left oculomotor palsy when he looked to the right; complete elevation of his upper lid was present when he fixed with the left eye. When he looked down he adducted the left eye and elevated the left upper eyelid. Wartenberg discussed the misdirection of regenerating fibers versus irradiation of impulses as a cause of these movements. He did not use the term irradiation. Nevertheless, he suggested the following points against the theory of misdirection of fibers as a cause of synkinesis:

1. Associated movements occur not only in recovery after trauma but after toxic infective neuritis.

2. Associated movements occur in nuclear lesions of the third nerve where a faulty peripheral nerve regeneration could not occur.

3. If misdirection of fibers had occurred, it would be natural to assume that fibers growing in a disorderly manner from the central into the peripheral stump would predominantly reach an adjoining neuron. Neighboring fibers, therefore, would intermingle most strongly and most frequently. This is not always the case.

4. Associated abnormal movements have occurred after lesions which have affected the end branches of nerves only. Misdirection of fibers could not be possible in such instances. Irradiation of impulses would explain them.

5. Such associated movements may occur in the seventh as well as the third nerve.

6. According to Wartenberg,[7] misdirection of fibers means a completely irregular, wild, free-for-all criss-crossing of the fibers where anything can happen. Associated movements however show a certain basic pattern which seems well preserved. Clinically there are *three muscles which show* the greatest tendency toward associated (synkinetic) movement; the levator, the internus, and, in addition, the inferior oblique muscle.

7. These associated movements do not change early and patients do not learn to suppress them as they do the undesired movements in nerve anastomosis.

Lyle,[8] by photographs, demonstrated synkinetic overaction of the inferior oblique

which disclosed a patient with a paralysis of the right external rectus as a result of herpes zoster. When this patient looked toward the right, the left eye was elevated abnormally. Lyle did not mention this overaction of the inferior oblique in his discusson on external rectus paralysis.

Along a similar line, Bulnoff and Heidenhain[9] discussed irradiation of impulses. They said, (a) as is well known, after stimulation of a given point of the motor cortex the epileptic spell spreads in an almost constant sequence to the different parts of the body, and, finally, (b) excitation becomes self sustained in the subcortical motor centers too.

In addition, Airing,[10] in discussing syndromes of the voluntary oculogyric center (area 8), discussed patients with convulsions in whom the eyes turned toward one side. The attack may be limited to the eye muscles, but in most cases it spreads to involve adjacent cortical areas (6 and 4). During the spread of the stimulus the eye movements are accompanied by turning the head and trunk to the opposite side and by sustained movements of the extremities.

Synkinesis is discussed by Spiegel and Sommer[11] under jaw-winking phenomena. They cited a case in which this phenomenon could be produced by stimulation of cortical foci in the frontoparietal region.

According to Spiegel[12, 13] a deviation of the eyes is first noticed after the stimulation of the inner ear close to the eighth nerve. This deviation becomes associated with retraction and turning of the head about a dorsoventral axis toward the opposite shoulder and an extension of the homolateral leg because the impulses spread to adjacent pathways.

If the bipolar electrode is not held close to the eighth nerve the current spreads to the neighboring afferent portions of the fifth, ninth, and tenth nerves.

In Duane's monograph synkinetic relationships are recognized. Duane mentioned the synkinesis between accommodation and convergence in discussing Donder's work and between the superior recti and the obliques.

The anatomic arrangement of the oculomotor nuclei may aid irradiation and therefore may explain synkinetic movements. The anatomic arrangement of the oculomotor complex was presented most concisely by S. Kinnier Wilson.[15] Wilson said that it is possible that each extraocular muscle is represented to a greater or lesser degree throughout the nucleus, some of whose pattern cells may be intercalary in type.

In addition he said that sensory fibers have been shown to exist in all the oculomotor nerves by Doziel, by Tozier, and by Sherrington.[17]

Whitnall discussed the connections of the oculomotor nucleus which may make synkinetic movements of the eyes possible. These connections are:

1. With the superior colliculus, through which impulses reach it from the visual system. (This connection may aid in explaining the presence of a hypertropia resulting from overcorrection of myopia and undercorrection of hypermetropia.)

2. With the cortical motor center for voluntary eye movements.

3. With the cerebellum through the superior cerebellar peduncle.

4. With the trochlear, abducens, and the vestibular, and possibly other nuclei, by means of the tectobulbar tract and medial longitudinal fasciculus.

Whitnall[16] also discussed normal synkinesis between the levator, the superior rectus muscle, and the frontalis, although these muscles may at times act independently, as in winking. The levator and frontalis may also act in a normal synkinesis as in expressing astonishment. All three muscles act in normal synkinesis in gazing upward.

Similarly, he noted that the frontalis, orbicularis, and corrugator display a tenderness associated with headache resulting from a spread of ciliary hyperkinetic and sensory impulses. These muscles are supplied by the facial nerve; whereas, the ciliary muscle is

innervated by the autonomic branch of the oculomotor nerve.

Along a similar line, Sherrington[17] definitely asserted that the oculomotor nerve is not only motor but sensorimotor. From his observations, one may therefore assume that aberrant impulses associated with irradiation and resulting in synkinetic hypertropia may pass out over the neurons of the third nerve.

Likewise, Chavasse[18] mentioned the *overflow* in which any sensory impression may result in excessive and finally uncoördinated ocular movement.

Similarly, Bender[19] stressed a synkinetic action of the right ciliary muscle following a skull fracture and a paralyzed oculomotor nerve which had improved in function. On contraction of any of the formerly paretic extraocular muscles, especially the inferior rectus, the sphincter pupillae contracted simultaneously. The clinical picture simulated an Argyll-Robertson pupil.

Bender and Alpert[20] showed that synkinetic pupillary reactions may be produced by experimental section of the oculomotor nerves in a monkey. They ruled out the presence of additional pupilloconstrictor fibers in other branches of the third nerve. Such pupilloconstrictor fibers are located only in the ciliary nerves.

Bender and Alpert[20, 21] in a similar vein, discussed synkinetic movements of the pupils and the orbicularis oculi.

Polyak[22] said spreading of a nervous impulse is a process requiring a measurable time. This implies certain differences in the dynamic status of the diverse parts of the neuron: its cytoplasmic core, its cortical zone, its surface film, its protoplasmic expansions, its axis cylinder, and its teledendron. For it is impossible to imagine an absolutely homogenous dynamical condition in all these diverse and often distant parts. This assertion may be invoked in support of my view concerning overaction of the inferior oblique.

In addition there may be local differences of a biochemical nature between various points of contact of a given neuron, too elusive to be demonstrated by the present technique.

Kestenbaum[23] considered these synkinetic movements to be normal in Bell's phenomenon and pathologic in Marcus Gunn's phenomenon.

From an examination of the literature one must accept the phenomenon of irradiation or spread of motor and of sensory impulses in most parts of the neuromuscular system. These irradiations may produce abnormal movements and atypical sensory responses.

Summary

When a paralysis is present resulting from an injury to a nerve some authorities attempt to explain the synkinetic movements by an ingrowth of fibers into adjacent neurons. These ingrowing fibers may carry impulses to the abnormally acting muscles. This opinion is difficult to substantiate, however, when a paralysis has not existed in so far as one can ascertain by history and examination.

Irradiation, overflow, or spread of impulses, a known physiologic phenomenon, explains more simply these synkinetic movements, especially of the inferior oblique muscle.

Case reports

The following case reports demonstrate the synkinetic overaction of the inferior oblique muscle and the various methods by which this overaction may be treated.

Case 1

Case 1 illustrates the overaction of the right inferior oblique resulting from an uncorrected hypermetropia.

History. D. W., a girl, aged four years, developed a right esotropia and right hypertropia after falling downstairs. Her birth was considered to have been normal.

Examination revealed a right esotropia

varying between 10 to 40 degrees and a right hypertropia of 15 degrees without lenses (fig. 1A) and a right esotropia of 20 degrees with correcting lenses (fig. 1B). The correction of the ametropia estimated under atropine cycloplegia was: R.E., +4.75D. sph. ⌒ 1.25D. cyl. ax. 90°; L.E., +4.5D. sph. ⌒ +1.50D. cyl. ax. 90°.

Treatment consisted of atropinization and glasses. After two years, squint was absent with glasses and the hypertropia had disappeared. Corrected visual acuity in each eye was 20/20; 14/14. An esophoria of 4 p.d. at far and 10 p.d. at near remained after treatment.

Results. No squint has been present with or without glasses since 1940 (figs. 1D and 1E). Prism vergences are: at far—divergence, 12 p.d.; convergence, 4 p.d.; supravergence, 8 p.d.; infravergence, 7 p.d., at near fixation—divergence, 24 p.d.; convergence, 24 p.d.

Summary. Synkinetic overaction of the right inferior oblique muscle decreased and disappeared after two years with the wearing of glasses and atropinization of the fixing eye.

Case 2

The details presented in Case 2 have for their purpose the demonstration that:

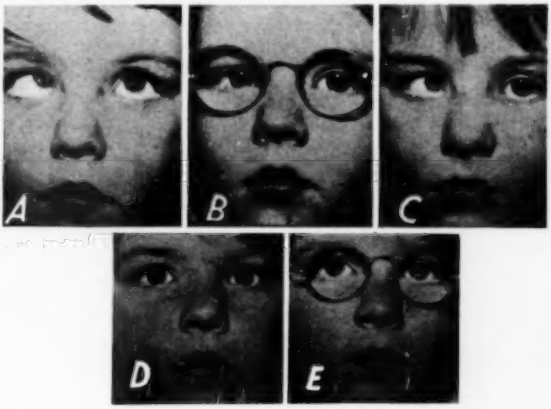

Fig. 1 (Guibor). SYNKINETIC OVERACTION OF INFERIOR OBLIQUE muscle resulting from uncorrected hypermetropia. (A) A right esotropia (40°), right hypertropia (15°), without corrective lenses. (B) Overaction of right inferior oblique decreased with corrective lenses before the eyes. (C) Overaction of right inferior oblique decreased after atropinization of both eyes. (D) Esotropia and hypertropia absent with and without glasses after two years. (E) Esotropia and hypertropia absent with glasses. (Note: No surgery was employed to overcome this synkinetic overaction of the right inferior oblique.)

1. Synkinetic overaction of an inferior oblique muscle may be associated with head tilting.

2. Nonsurgical treatment may relieve this hypertropia.

History. L. M., a Mexican girl, aged four years, was seen for the first time in the clinic for motor anomalies on December 7, 1936. Her mother reported that a right esotropia had appeared suddenly, following pertussis and measles in January, 1936.

Examination revealed an alternating esotropia of 15 degrees at near fixation, 10 degrees at far without and with lenses, which were: R.E., +3.75D. sph. ⌒ 1.75D. cyl. ax. 105°; L.E., +3.75D. sph. ⌒ 1.5D. cyl. ax. 75°. Visual acuity in each eye was 20/50.

At times an overaction of each inferior

oblique was present which was associated with head tilting (figs. 2A and 2B). Alternating monocular vision was present.

Treatment. After atropinization of the eyes at regular times and intervals, the deviation decreased and disappeared. Visual acuity, binocular vision, and stereoscopic ability became normal. Head tilting and overaction of the inferior obliques disappeared without surgical treatment (figs. 2C and 2D).

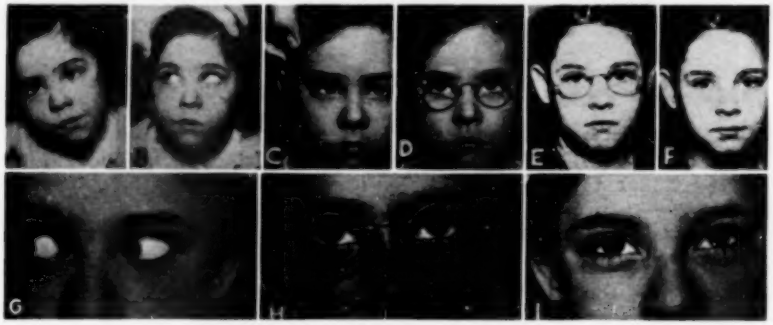

Fig. 2 (Guibor). SYNKINETIC OVERACTION OF INFERIOR OBLIQUE muscle associated with head tilting relieved by nonsurgical treatment. (A) Left esotropia with left hypertropia resulting from synkinetic overaction of the left inferior oblique. (B) Considerable overaction of left inferior oblique looking to the right. (C) Fixing with left eye—right esotropia (15° to 20°) without glasses. (D, E, and F) Esotropia and hypertropia decreased and disappeared even without glasses. (G) Overaction of inferior oblique absent after five years of nonsurgical treatment. (H and I) Esotropia and hypertropia absent after 10 years. (Note: No surgery was employed.)

Results. On November 19, 1946, an esophoria of 6 p.d. was present at far and at near fixation with glasses. Overaction of the left inferior oblique disappeared. Visual acuity in each eye was 20/13. Good binocular vision was present (figs. 2E, 2F, 2G, 2H, and 2I).

CASE 3

The presentation of Case 3 is for the purpose of demonstrating synkinetic overaction of both inferior oblique muscles associated with a spastic type of esotropia. The overactions of these inferior obliques and of the interni became so severe that surgical intervention was necessary. Likewise, base-out prisms and vertical prisms did not overcome the esotropia and hypertropia. It was concluded therefore that a permanent contracture of the vertically acting inferior obliques had occurred. The motor defects resembled bilateral superior rectus palsies with overactions of the inferior obliques.

History. On March 15, 1927, D. H., then one year of age, entered the Children's Memorial Hospital Ophthalmic Clinic because of an esotropia. This squint had appeared when she was two months of age (fig. 3A). Note that a small degree of squint (15°) was visible at the age of two months.

Examination revealed an alternating esotropia varying from 35 to 65 degrees (figs. 3B, 3C, 3D, and 3E). In addition there was considerable weakness of the externi, the superior obliques, and the superior recti. A severe overaction of the interni and both inferior obliques gradually became apparent (figs. 3E, 3F, 3G). In addition, head tilting occurred which the examiners believed resulted from abnormal proprioceptive impulses.

Base-out prism tests (figs. 3H and 3J) did not relieve the hypertropia (fig. 3J). It was therefore assumed that a contracture of the inferior oblique muscle had occurred.

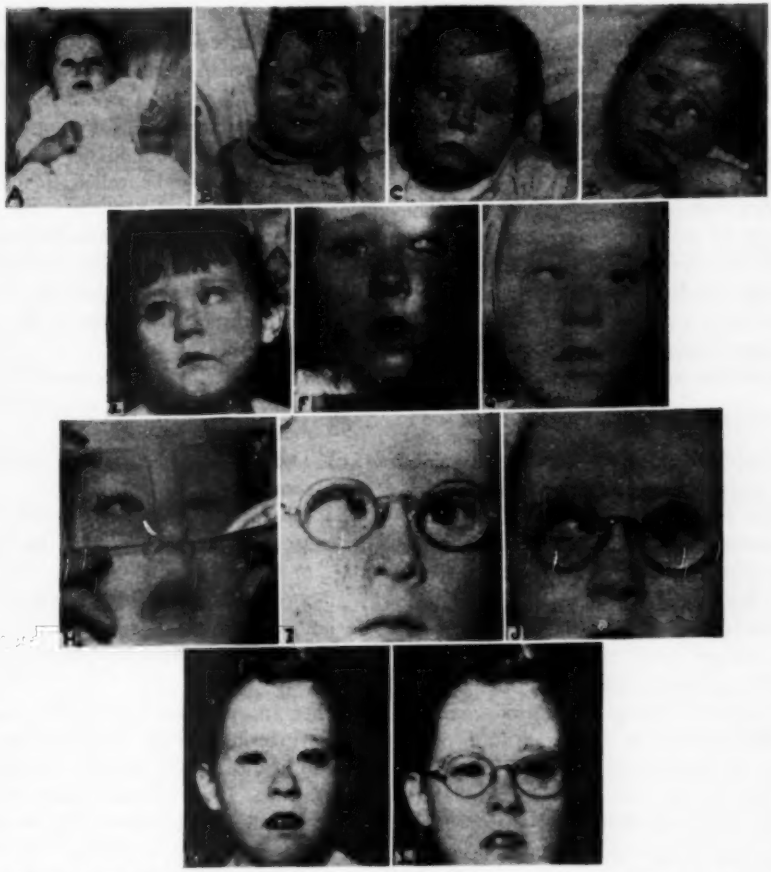

Fig. 3 (Guibor). GRADUAL DEVELOPMENT OF SYNKINETIC OVERACTION of inferior oblique in a case where severe overactions of the interni were present. (A) At the age of 3 months, right esotropia (20°). (B) At the age of 11 months, alternation developing; left esotropia (25°). (C) Right esotropia, (35° to 45°), right hypertropia (20°), head tilting to the left. (D and E) At the age of 15 months, left esotropia (60°), left hypertropia (20°). (F) At the age of 8 years, severe contracture of left internal rectus and left inferior oblique; overaction of left inferior oblique becoming constant; suggests a paralysis of right superior rectus. (G) At the age of 8 years, right esotropia (50°), moderate overaction of right inferior oblique with right esotropia. (H, I, and J) Base-out prisms did not relieve overactions of right inferior oblique. (K) Results following surgery (without glasses), right esotropia (10°); no overaction of inferior obliques. (L) Results following surgery (with glasses), right esotropia (15°); no overaction of either inferior oblique.

Surgery was advised and was done on July 21, 1944, as follows:

1. Retroplacement of the left internus 3 mm.
2. Resection both externi 8 mm.
3. Myectomy right inferior oblique.
4. Tenotomy left inferior oblique.

Following the operative procedure, a right esotropia of 10 degrees without lenses was noticeable (fig. 3K). No squint was present with glasses (fig. 3L).

Postoperative course. The error of refraction estimated while the eyes were atropinized, revealed: R.E., +5.5D. sph. ⌒

+0.5D. cyl. ax. 90°. = 20/20; L.E., +1.50D. sph. ⊂ +2.25D. cyl. ax. 90° = 20/20. These glasses were prescribed and are being worn at the present time.

July 9, 1944. The tenotomy of the left inferior oblique did not result in a permanent relief from the hypertropia. The cover test revealed a left hypertropia of 25 p.d. The myectomy of the right inferior oblique successfully removed the right hypertropia.

Results. On November 3, 1945, the cover test revealed a right esotropia of 20 p.d. and a left hyperphoria of 25 p.d. Alternating monocular vision was present.

Summary

The application of the knowledge gained by the study of synkinetic deviations emphasized the following facts:

1. Accommodative excess or hypertonia may produce an overaction of the inferior oblique because the nucleus of Perlia (for accommodation) is connected with the inferior oblique (and the superior rectus). Similarly, an uncorrected hypermetropia or an overcorrected myopia may produce a vertical disturbance (as much as four prism diopters of hyperphoria).

2. Convergence excess or "spasm" likewise produces these vertical disturbances. The anatomic details, in addition, suggest that if either one or all synergists of the inferior oblique (the superior recti and the fellow inferior oblique) are affected either by an individual paresis or by the hypertonic centers, the other inferior oblique likewise is overstimulated and thus displays a synkinetic overaction.

3. Again, the connections of this muscle with the contralateral external rectus is made possible through the medial longitudinal fasciculus. It is important to realize that this connection in an abducens palsy may permit abnormal impulses reaching the contralateral inferior oblique when the patient with the external rectus palsy attempts to abduct the defective eye. In such instances the excessive impulses necessary to abduct this eye are likewise sent to the contralateral internal rectus and inferior oblique to produce a secondary deviation (an esotropia and a hypertropia of the sound eye). In these instances, of course, there is nothing defective with the inferior oblique or the superior oblique. They may be called a synkinetic overaction.

4. The treatment of synkinetic overaction of the inferior oblique muscle and the associated hypertropia should include:

a) An accurate correction of the refractive errors by lenses.
b) The hypertropic eye should be made to fix by occlusion or atropinization of the fellow eye.
c) The horizontal fusional amplitudes should be improved.
d) Horizontal deviations should be corrected before the vertical by base-out or base-in prisms.

If horizontal prisms of the proper degree do not improve the vertical deviation, then recession of the inferior oblique is indicated.

When an operation is necessary, recession of the inferior oblique muscle is the operation of choice to correct the overaction of this muscle. It is indicated only when the overaction does not improve by the wearing of horizontally placed prisms. The overaction of the inferior oblique muscle in these cases which require surgery should be present when the eyes are in the primary or in the convergent positon.

Conclusion

Synkinetic overaction of the inferior oblique is of common occurrence. It probably results from irradiation of impulses. Nonsurgical treatment is often successful. Nonsurgical treatment should be tried before resorting to myectomy or recession of the inferior oblique muscle.

30 North Michigan Avenue (2).

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SIGNIFICANCE OF OCULAR TENSION IN HEMORRHAGE OF THE FUNDUS OF THE EYE*

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Although cases of pathologically increased intraocular pressure are frequently reported in the literature, comparatively little attention has been given to reports of low ocular tension. In a study of hemorrhage of the fundus of the eye, I found only occasional mention of pathologically low ocular tension; yet it is well known that some cases of glaucoma, after operation, react to the suddenly decreased tension by hemorrhage of the fundus resulting from hydrops ex vacuo.

Igersheimer[1] reports a case which, despite high blood pressure and considerable nitrogen lag, developed no hemorrhage of the fundus. He explains it by the developed glaucomatous excavation.

For 20 years,[2] we have been investigating the relationships between the circulatory system and the eye. During this time we have examined about 1,500 cases by various methods (oscillography, capillary microscopy, capillary-pressure determination, ophthalmodynamometry, and provocative tests among which were the recent cold pressor tests).

Of these 1,500 cases, 500 were of various types of glaucoma and 200 showed hemorrhages of the eye. In the glaucoma cases, hemorrhages of the fundus were very rare, and our investigations would seem to indicate that hemorrhages of the fundus of the eye are not related to the increased intraocular pressure.

Oscillography seemed to indicate that the circulatory system of glaucomatous persons was of satisfactory tonicity. In 83 percent of the cases of hemorrhage of the fundus of the eye, however, the oscillograms showed wide excursions,[3] suggesting that elastic elements of the vessel walls had been destroyed.

Under such circumstances, the circulatory system of the fundus of the eye is atonic (Fritz), predisposing for hemorrhage by rhexis or diapedesis. In 70 percent of the cases of hemorrhage of the fundus, blood pressure registered above 180 mm. Hg. Even in the 30 percent of cases having normal blood pressure, there were wide excursions on the oscillograms.

Such findings posed the question as to what sort of mechanism and what local causes had to be assumed as being responsible for the development of hemorrhage of the fundus of the eye in those cases with normal blood pressure and normal oscillographic recordings.

Wessely was the first to state that, in advanced cases of thrombosis of the central vein, the blood pressure is lower on the side of the thrombosis. Basing our therapy on former studies[4] and recent experiments[5] concerning venous pulsation in the fundus of the eye, we have treated cases, in which the vessels of the fundus and the retinal circulation were altered, by intravenous injection of hypertonic saline, and these cases have shown improvement. When this treatment is administered, cranial pressure is decreased by osmosis, with simultaneous decrease of pressure within the central retinal vein, and the result is an improvement in the circulation of the fundus.

We have learned through experience, however, that this form of therapy is contraindicated in cases of hemorrhage of the eye. In Case 3 (Table 1) with a thrombosis of the central retinal vein, an injection of

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hypertonic saline produced a drop in ocular tension from 16 mm. Hg to 12 mm. Hg and the hemorrhage of the fundus of the eye increased. It was the reaction in this case that induced us to make a systematic investigation of the ocular tension in cases of hemorrhage. The results of this investigation are shown in Table 1.

With one exception (Case 6) ocular tension was conspicuously low—that is, if hemorrhage took place in one eye only, the tension of the affected eye was even lower when compared to the unaffected eye.

It is well known that, in cases of high blood pressure, hemorrhages of the fundus of the eye may develop. It is not so well known, however, that, if high blood pressure is combined with low intraocular pressure, the possibility of hemorrhage is increased.

Of great interest and most instructive are the hemodynamic conditions seen in cases

TABLE 1

RESULTS IN A STUDY OF THE RELATIONSHIP BETWEEN BLOOD PRESSURE, OCULAR TENSION, AND HEMORRHAGE OF THE FUNDUS OF THE EYE

No.	Name	Sex	Age	Blood Pressure	Ocular Tension	Diagnosis
1	S.F.	♂	65	170/ 90	16 12	Throm. CRV (left)
2	A.V.	♂	52	140/ 85	23 18	Throm. CRV (left)
3	I.P.	♂	45	220/100	24 16	Throm. CRV (left)
4	L.W.	♀	52	140/60	20 14	Hem. per rhexin
5	F.E.	♂	63	210/120	14 14	Ret. albumin o.u.
6	F.F.	♂	66	245/120	22 20	Ret. diabetica o.u.
7	A.K.	♀	65	270/120	10 10	Ret. diabetica o.u.
8	I.B.	♂	64	180/ 85	18 18	Ret. diabetica o.u.
9	S.L.	♀	60	210/90	9 12	Ret. diabetica o.u.
10	J.N.	♀	60	170/ 80	14 14	Ret. diabetica o.u.
11	I.G.	♂	73	200/ 85	18 15	Ret. diabetica o.u.
12	L.M.	♀	45	170/ 80	18 18	Ret. diabetica o.u.
13	T.G.	♂	72	260/100	11 11	Ret. diabetica o.u.
14	D.H.	♂	68	200/100	16 16	Ret. diabetica o.u.
15	A.R.	♀	66	170/ 85	15 15	Ret. diabetica o.u.

of diabetic retinitis in which the blood pressure is normal (Cases 10, 12, 15). In these cases, as was usual in all of our diabetic cases, microscopic study of the capillaries disclosed a phenomenon which was conspicuous and which has been repeatedly described in the literature.

This phenomenon—the Schaltstück described by German authors—is the marked dilatation in the interval between arterial and venous communication and explains the point-shaped hemorrhages that occur by diapedesis in the fundi of diabetic patients. (Capillaroscopy also revealed similar point-shaped hemorrhages in the fundi of individuals returning from deportation in an emaciated state.)

It is rather remarkable that in not one of the 15 cases reported herein (Table 1) was there any hemorrhage visible upon capillaroscopy of the nail bed. It would seem that the presence of some local factor is necessary for the development of hemorrhage of the fundus of the eye in these cases. And it is our belief that this factor is—a diminished ocular tension.

Elwyn[6] says: "It is my opinion that, in its pathogenesis, diabetic retinitis stands in close relation to the continuous hyperglycemia which is in all probability responsible for the condition in the capillaries resulting in hemorrhages."

Whether the thrombosis of the central retinal vein develops in the right or in the left eye is decided by several factors. According to Horniker, brachial blood pressure is larger on the thrombotic side. Wessely believes, as already mentioned, that ocular tension is lower in that eye. Our own investigations disclose that oscillograms taken on the thrombotic side (brachial) show wider excursions. These three factors, taken separately or together, determine on which side the thrombosis of the central retinal vein will be localized.

Summary

General and local factors are responsible for hemorrhages of the fundus of the eye.

Among the general factors are increased blood pressure, diminished elasticity of the vessel walls, and dilatation of the capillaries.

The local factor responsible for the hemorrhages of the fundus of the eye is a decreased ocular tension.

Hemorrhage of the fundus of the eye occurs when dilated retinal capillaries are associated with low intraocular pressure.

V., Személynök-u. 9-11. ½ 3.

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THE USE OF MIOTICS IN THE TREATMENT OF CONVERGENT STRABISMUS AND ANISOMETROPIA*

A Preliminary Report

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The literature contains few references to the use of miotics in eyes in which no pathologic conditions are present. Miotics have been used for many years in the treatment of glaucoma and as a precautionary measure after mydriatics. Other uses of miotics are concerned with intraocular surgery, as after intracapsular cataract extractions. The use of weak solutions of miotics (0.125-percent solutions of pilocarpine HCl) as an aid in early presbyopia was mentiined many years ago. Miotics have been used to decrease intraocular pressure and thus improve the vascular condition in diseases of the fundi and in optic atrophy. Mention is also made of the use of miotics in a study of entopic phenomenon.

Drugs used in experiment

In this preliminary report on the use of miotics in convergent strabismus and anisometropia, the drugs used were pilocarpine hydrochloride, eserine salicylate, and di-isopropyl flourophosphate (D.F.P.). The pharmacology is similar in these drugs, in that all three are parasympathomimetic. They differ in that D.F.P. has a more prolonged action. This is explained by the nature of the action of these drugs on cholinesterase. D.F.P.'s inhibiting action on cholinesterase is irreversible. The action of eserine and pilocarpine is reversible. The cholinesterase inhibited by D.F.P. must be regenerated or replaced from other body depots.

These drugs, chiefly pilocarpine hydrochloride, were used locally by instillation in the conjunctival sac. The effect of these drugs was always transitory, naturally longer with D.F.P. than with pilocarpine. This meant that when using pilocarpine, the instillations would necessarily be more frequent than when using the stronger drugs, such as D.F.P.

In using pilocarpine, occasional complaints of blurring were encountered. The use of eserine and D.F.P. gave rise to more complaints. There was local redness and pain. Headaches were not infrequent. Blurring of distance vision and even near vision was complained of more frequently. This was especially true of D.F.P. However, persistent use over a two-week period would tend to lessen these symptoms. One of the disturbances complained of, especially in adults, was the considerable decrease in brightness of objects. This was no doubt due to the miosis obtained.

The work reported here had its inception in 1929, at the University of Vienna, when miotics were used on animals in a vain attempt to produce myopia. The animals died prematurely from intercurrent disease. The same experience was suffered in 1930 at the University of Chicago. It was not until 1939 that I attempted to use miotics on normal human eyes.

The use of miotics was undertaken to decrease permanently the amount of hyperopia present as a first step in experimentally producing myopia. This phase of the experiment was unproductive. Cases of hyperopia in which a miotic was used for almost three years showed little or no appreciable downward change in the refraction. However, certain definite observations were made and these form the basis of this report.

The miotics used produced not only a miosis but a spasm of accommodation defi-

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nitely measurable (case A). During the state of spasm the need for plus lenses was theoretically and clinically reduced. This action on the accommodation is a peripheral one. This differentiation is important in any consideration of the accommodation-convergence relationship.

Case A: Showing accommodative spasm produced by 0.25-percent eserine. R. G., a man, aged 22 years, had homatropine hydrobromide (2-percent solution) instilled into the conjunctival sac of each eye, every 10 minutes for 6 doses. At the end of one hour the refraction was: R.E., +0.25D. sph. ⌒ +0.75D. cyl. ax. 90° = 1.2; L.E., +0.50D. sph. ⌒ +0.75D. cyl. ax. 90° = 1.2. This was followed by one drop of 0.25-percent solution of eserine salicylate instilled into each conjunctival sac at intervals of 5 minutes for 3 doses.

Within one-half hour after the first use of eserine, there was marked pain in each eye with spasm of the eyelids. Vision was markedly blurred for distance. Vision of the right eye with a −5.0D. sph. was 1.0; of the left eye with a −3.0D. sph., 1.0. Homatropine had to be reinstilled to relieve the spasm.

Report of cases

A miotic was advised in a total of 80 cases. However, either because the patient did not return or the parent decided not to coöperate after no more than three days' use, the number of cases available for the report is 50.

Of this number, 46 cases were of convergent strabismus. Two of these cases (cases 45 and 46) showed definite anisometropia. Four other cases of anisometropia showed no strabismus (cases 47 to 50, inclusive).

There were 44 cases of convergent strabismus of the isometropic type. In 22 of these cases (table 1), the condition was periodic (unilateral or alternating) when first seen. The average age of onset of the strabismus in this group was 3.27 years, varying from 0.5 to 6 years. The average age of the patient when first seen by me was 5.19 years, varying from 2 to 17 years.

The visual acuity of these cases was approximately equal. When this was not true, a short period of amblyopic treatment (usually by atropinization of the better eye) produced equality. In 16 of these cases, the addition of miotics to the therapy was helpful. By "helpful" is meant that the eyes showed single binocular fixation and grossly normal function while using the miotic.

In 5 of these 16 cases, the eyes remained cosmetically straight and functioned together normally (except as noted in remarks—case 3) after discontinuance of the miotic for at least six months (cases 1, 2, 3, 4, and 5).

In the second group of 22 cases (tables 2 and 3), the strabismus was of the constant isometropic convergent type, unilateral or alternating, when first seen. In 16 of these, the type had been changed by treatment to the periodic type before the miotic was used. These are shown in Table 2. The visual acuity could not always be determined accurately. The change in type to the periodic form under treatment justified the assumption of approximate equality in vision before using the miotic.[8]

The average age of onset of the strabismus in these 16 cases was 1.7 years, varying from 0.5 to 3.5 years. The average age of the patient when first seen by me was 6.15 years, varying from 1.5 to 18 years.

In 15 of these 16 cases the use of a miotic was helpful. In 3 of these, the eyes showed no definite strabismus after the miotic was discontinued for at least six months (cases 23, 24, and 25).

Six of the 44 cases showed a constant strabismus when first seen and continued to do so after treatment to the time when miotics were added (table 3). The average age of onset in these cases was 1.25 years, varying from 0.5 to 2.5 years. The average age of the patient when first seen by me was 4.9 years varying from 2.0 to 6 years. In 5 of these cases the use of a miotic helped. In 3 of these 5 cases after discontinuance

TABLE 1[1]

SHOWING AFFECT OF MIOTICS IN 22 CASES OF NONPARALYTIC STRABISMUS OF THE ISOMETROPIC PERIODIC CONVERGENT TYPE[2]

Case	Sex	Age 1st Seen	Age Onset	Prev. Rx.	Refraction	V.a. Corr.	Rx. b.m.	Strt. w.g. b.m.?	Mi. Used	Results Imm.	Results Late	Mos. Used	Remarks
1	F	6	5	N	+1.75 + .25c +2.00	1.0 1.0	N	—	P. 1% bid	Strt. w.o.g.	cured	4½	Not strt. with atropine.
2	F	6	5½	N	+2.75 +0.50c +4.00 +1.00c	1.0 0.2	A-G	Yes	P. 1% bid	Strt. w.o.g.	cured	18	RV = LV = 1.0 b.m.
3	M	5½	½	G	+3.00 +3.00	1.0 1.0	G-S	No	P. 1% tid	Strt. w.o.g.	cured	2	Recurrence responded to Rx.
4	M	17	5	G	+3.00 +0.50c +3.25 +1.25c	1.0 1.0	G-S	No	P. 2% tid	Strt. w.o.g.	cured	21	
5	M	3½	2½	N	+3.50 +1.25c +3.50 +1.25c	1.0 1.0	G-S	No	P. 1% tid	Strt. w.o.g.	cured	12	
6	M	6	5	N	+2.25 +2.50	0.6 0.6	N	—	P. 1% bid	Strt. w.o.g.	H	4½	Did not help twin (case 21).
7	F	3½	3	G	+4.00 +0.75c +4.00 +0.50c	1.0 1.0	G	Yes	P. 1% tid	Strt. w.o.g.	H	9	Finally asked for g. Trble using P.
8	M	3	2½	N	+4.75 +0.25c +5.00	—	N	—	P. 1% bid	Strt. w.o.g.	H	3	G. given later & eyes straight.
9	M	4½	4	N	+5.00 +0.50c +6.50	1.0 1.0	N	—	P. ½ % tid	Strt. w.o.g.	H	14	G. given later & eyes straight.
10	F	2½	1	G	+6.00 +0.25c +5.50 +0.25c	—	G	Yes	P. 1% tid	Strt. w.o.g.	H	6	
11	F	6	5½	N	+1.50 +2.25	1.0 1.0	N	—	P. 1% bid	Strt. w.o.g.	H	8	After 3 weeks P. or g. no help.
12	M	9	6	G	+4.00 +4.50	1.0 1.0	G	Yes	P. 1% tid	Strt. part of time	H?	6	P. helped but preferred g.
13	M	3½	3	N	+4.25 +4.25	1.0 1.0	G-A	Yes	P. 2% bid	Strt. w.o.g.	H	11	RV = LV = 1.0 w&w.o.g. Later g. for school.
14	M	4	3½	N	+4.00 +1.25c +3.25 +0.75c	0.3 1.0	G-A	Yes	P. 2% tid	Strt. w.o.g.	H	4	3 mos. later RV = LV = 1.0 w.g. RV = 0.3LV = 1.0 w.o.g.
15	M	8	2	S	+2.25 +0.75c +2.25 +0.75c	1.0 1.0	S	—	P. 1% bid	Less C.	H?	2 wks.	Operation after 6 for L.C.(?).
16	F	6	2½	G-A	+2.25 +4.25c +3.75 +3.50c	0.8 0.6	G-A-S	No	P. 2% tid	Strt. w.o.g.	H	12	Strt. w.o.g. after more A. Rx.
17	F	3	3	G	+4.50 +4.75	—	G	Yes	P. 2% bid	Not strt.	F	2 wks.	Later vision. R = L = 1.0
18	F	2½	2½	N	+4.00 +0.50c +5.00 +0.50c	—	G	Yes	P. 1% tid	Not strt.	F	1 wk.	6 yrs. later strt. w&w.o. gls.
19	F	4	4	N	+2.25 +2.25	1.0 1.0	A	—	P. 1% bid	Not strt.	F	1 wk.	Psychic factor.
20	M	3	—	N	+3.00 +0.75c +3.00 +0.75c	—	A	—	P. 1% bid	Not strt.	F	2 wks.	
21	M	6	5	N	+3.00 +3.50	0.6 0.6	G	No	P. 2% bid	Not strt.	F	2 wks.	Twin to Case 6.
22	M	2	early	N	+2.25 +2.25 +0.25c	—	A-S	—	P. 1% bid	F	F	2	P. used in poor L.V. afte A. Rx eyes strt.

[1] See REFERENCE 1.
[2] See REFERENCE 2.

of the miotic, there was no recurrence of the strabismus for the period of observation which was at least six months (cases 39, 40, and 41).

The average length of time the miotic was used in the total of 11 cases apparently cured by the addition of miotics was 15 months, varying from 2 to 32 months.

The eyes were straight with glasses in 17 of the 44 cases. Fourteen of these cases were straight without the glasses when using the miotic.

TABLE 2[1]

SHOWING THE AFFECT OF MIOTICS IN 16 CASES OF NONPARALYTIC STRABISMUS OF THE ISOMETROPIC CONSTANT CONVERGENT TYPE[2] PREVIOUSLY MADE PERIODIC BY OTHER TREATMENT

Case	Sex	Age		Prev. Rx.	Type Sq. 1st Seen	Refraction	V.A. Corr.	Rx. b.m.	Strt. w.g. b.m.?	Type Sq. b.m.	Mi. Used	Results		Mos. Used	Remarks
		1st Seen	On-set									Imm.	Late		
23	F	18	2	G	LC 25°	+3.75 +0.75c +4.25 +0.75c	1.0 0.8	G-S	yes	LPC	P. 2% tid	strt. w.o.g.	cured	24	Used g. part time. Muscle tests o.k.
24	F	3½	early	N	LC 20°	+3.50 +1.75c +5.25 +1.50c	— —	G-A-S	yes	LC w.o.g.	P. 2% tid	strt. w.o.g.	cured	13	
25	F	15	2	N	RC 25°	+1.75 +1.50c +2.75 +0.50c	1.0 1.0	G	yes	RPC	P. 1% bid	strt. w.o.g.	cured ?	30	G. school only. Alternate suppression.
26	F	2	1	G	LC 30°	+9.50 +9.50	— —	G	yes	LPC	P. 2% tid	strt. w.o.g.	H	2	Using interchangeably w.g.
27	F	8	2½	G	AC 25°	+3.75 +4.25	1.0 1.0	G	yes	APC	P. 2% bid	strt. w.o.g.	H	11	G. given for school.
28	F	5½	3½	G	RC 25°–40°	+5.00 +5.00	0.8 1.0	A-G	yes	APC	P. 2% bid DFP 0.1%	strt. w.o.g.	H	27	D.E.P. 1X q 2 days with same results.
29	M	4	3½	N	RC 25°	+5.50 +1.50c +4.75 +1.50c	0.1 1.0	A-G	yes	RPC	P. 2% tid	strt. w.o.g.	H	30	RV =0.6 b.m. Later RV =1.0.
30	M	3	1	N	RC 30°	+2.75 +3.50	—	A-S	—	APC	P. 1% bid	strt. w.o.g.	H	6	Continiung P.
31	F	13	3	G-S	AC 25°	+3.50 +1.00c +4.50 +1.50c	1.0 1.0	G-S-A	no	LPC	P. 2% bid	strt. w.o.g.	H	24	P.L.E. only. G. school only.
32	F	2	½	N	AC 35°	+5.50 +0.50c +5.50 +0.50c	— —	G-S-A	no	LPC	P. 2% tid	strt. w.o.g.	H	3 wks.	Strt. w.g. then and preferred g.
33	M	5	½	N	LC 35°	+4.50 +2.00c +4.50 +2.00c	0.6 ecc	G-A-S	no	APC	P. 2% tid	strt. w.o.g.	H	3	P.L.E. 14 months. Strt. w.P. w.&w.o.g.
34	F	5½	2	G	LC 25°	+2.50 +0.75c +2.50 +1.00c	1.0 0.6	G-A-S	P.C. w.g.	LPC	DFP 0.1	strt. w.o.g.	H	2	DFP 1X q 2 days.
35	F	1½	1	N	RC 30°	+7.50 +2.50c +7.00 +2.00c	— —	G-A-S	APC w.g.	APC	P. 1% bid	strt. w.g.	H	2	RV = LV =0.6 at 4 yrs. Rx 2.0D. below Atr.
36		9½	3	G-S	LC 15°	+3.50 +0.25c +5.00	1.2 1.0	G-S	LPC w.g.	LC w.o.g.	P. 1% bid	strt. w.g.	H	6	G. 1.0D. below Atr.
37	F	1½	1½	N	AC 20°	+4.50 +1.00c −5.50 +1.25c	— —	A-G	yes	APC	P. 2% tid	strt. w.o.g.	H?	3	At. 3½ RV =1.0. LV =0.4 and APC with P.
38	M	2	½	N	LC 15°	+5.00 +5.50	— —	G	yes	APC	P. 2% tid	not strt.	F	2 wks.	Later Vision R = L =1.0.

[1] See REFERENCE 1.

TABLE 3[1]

SHOWING AFFECT OF MIOTICS IN 6 CASES OF NONPARALYTIC STRABISMUS OF THE ISOMETROPIC CONSTANT CONVERGENT TYPE[2]

Case	Sex	Age 1st Seen	Age Onset	Prev. Rx.	Type Sq. 1st Seen	Refraction	V.A. Corr.	Rx. b.m.	Strt. w.g. b.m.?	Type Sq. b.m.	Mi. Used	Results Imm.	Results Late	Mos. Used	Remarks
39	F	8	?	N	RC 10°	+2.75+0.50c +2.75+0.50c	0.6 1.0	A	—	RC	P. 1% tid	Strt. w.o.g.	Cured	7	RV=LV=1.0. After Rx.
40	F	6	1½	G	AC	+4.25+1.25c 90° +4.50+1.50c 90°	1.0 1.0	G-S	No	AC	P. 1% tid	Strt. w.o.g.	Cured	32	Muscle test o.k.
41	M	6	2½	G-S	AC 25°	+5.75+0.50c +5.75	1.0 1.0	G-S	No	AC	P. 2% tid	Strt.	Cured	2	R.C. at onset. No further S.
42	F	3½	2	G-S	RC 25°	+3.75+1.75c +3.75+1.75c	ecc. 0.5	G-S-A	No	AC	P. 1% bid	Strt. w.o.g.	H	4	G. later and strt. RV=LV=0.8.
43	M	4	early	G	AC 25°	+7.00+1.00c +7.00+1.25c	0.3 0.5	G-A	No	AC	P. 2% tid	Strt. w.o.g.	H	6	Used longer (1½ yrs.) w.g. for school.
44	F	2	½	N	RC 25°	+3.50 +3.50	— —	A	—	AC	P. 2% bid	Not strt.	F	3 wks.	

[1] See REFERENCE 1.
[2] See REFERENCE 2.

TABLE 4[1]

SHOWING THE AFFECT OF MIOTICS IN THE 2 CASES OF ANISOMETROPIA WITH CONVERGENT STRABISMUS (A) AND IN THE 4 CASES OF ANISOMETROPIA WITHOUT STRABISMUS (B)

Case	Sex	Age 1st Seen	Age Onset	Prev. Rx.	Type Sq. 1st Seen	Refraction	V.A. Corr.	Rx. b.m.	Strt. w.g. b.m.?	Type Sq. b.m.	Mi. Used	Results Imm.	Results Late	Mos. Used	Remarks
									A						
45	F	19	3	G-S	LD 35°	+6.50+0.50c +4.75+2.75c	1.0 0.8	G-S	Yes	LC 15° w.o.g.	P. 2% L.E.	Strt. w.o.g.	H	24	Uses P. for stage and socials. L.C. at onset.
46	M	3	?	N	LC 15°	+1.25+0.50c +4.50+0.50c	0.6 0.1	A	—	LC	P. 1% tid L.E.	F	F	2 wks.	P. used with LV=0.1.
									B						
47	M	32	—	G	—	+1.5 +0.25c +3.75+0.75c	1.0 1.0	G	—	—	P. 2% L.E.	—	H	30	Definite increase in comfort.
48	F	30	—	G	—	+1.50 +4.50	1.0 1.0	G	—	—	DEP 0.1 L.E.	—	H	1	1×q. 3 days and happy w.o.g.
49	F	14	—	G	—	+0.50+0.50c +5.25+0.75c	1.0 0.5	G	—	—	Eser ¼% L.E. bid	—	H	5	O.K. w.o.g.
50	M	9	—	G	—	+1.75 +5.50	1.0 0.6	G	—	—	P. 1% L.E.	—	H	12	L.V. =1.0 w.P. Happy w.o.g.

[1] See REFERENCE 1.

The eyes were not straight with glasses in 15 of the 44 cases. In 14 of these, the eyes were straight without glasses on using a miotic.

In 12 cases no glasses were given, chiefly because the error of refraction was usually less than +3.50D. sph. (only 2 such cases showed higher defects, case 8 and case 9). In 8 of these cases, the eyes were straight when using the miotic alone.

Recurrence occurred in one case (case 3) but further use of the miotic resulted in elimination of the strabismus. Three of the cases grouped with the helped cases were only partially helped by the miotic (cases 15, 35, and 36).

In no case was the strabismus increased or in any way aggravated by the use of a miotic.

In two cases of anisometropia with strabismus (table 4-A), the miotic was used only in the highly ametropic eye. In one of these cases the strabismus disappeared with no further treatment (case 45). In the failure (case 46), the miotic was used when the difference in visual acuity was still marked.

In 4 cases with anisometropia without strabismus (table 4-B), the miotic in the most ametropic eye enabled the patient to get along with binocular activities without glasses and with considerable subjective improvement (cases 47 to 50, inclusive).

Summary and discussion

Altogether 36 cases or 81.8 percent of the isometropic type of nonparalytic convergent strabismus with essentially equal vision were helped or cured with the aid of miotics.

Surgery alone or in combination with other treatment was done some time before the use of miotics in a total of 18 cases. These cases still required therapy after surgery, further operations being considered. The use of miotics in these cases helped in 17 cases without more surgery (cases 3, 4, 5, 15, 16, 22, 23, 24, 30, 31, 32, 33, 34, 35, 36, 40, 41, 42) resulting in cures in 7 of these cases (cases 3, 4, 5, 23, 24, 40, and 41).

In 39 of the 44 cases referred to above, the error of refraction was 3.0 diopters or more. The use of miotics was of definite help or resulted in a cure in 33 of these cases. Miotics helped in 3 of the 5 cases with the error of refraction under 3.0 diopters.

Little[4] reported use of contact glasses in unilateral aphakia with disappearance of the strabismus (divergent). The use of a miotic in unilateral high hyperopia acts similarly to equalize the vision and the size of the images in anisometropia with or without strabismus. To what extent the size of the images are equalized and how this method compares with the method of aniseikonic correction remains for further study. The possibility of using miotics instead of contact lenses in high hyperopia, bilateral as well as unilateral, is suggested.

Occasionally cases with equal corrected vision for distance showed marked differences in naked visual acuity between the two eyes which was not fully explained by any difference in error of refraction (cases 14 and 29). It seems quite likely that the difference in corrected and uncorrected vision is due to a difference in accommodative action or ability between the fixing eye and the previously amblyopic eye. That accommodative inequality in binocular vision is usually not greater than 1.5 diopters is claimed and well supported by Grimm[5] and others before him. The conditions in strabismus, however, are not normal.

An amblyopic eye in strabismus with active suppression of its vision over a long period of time should, from a physiologic viewpoint, have an inactivated (or lessened) accommodation. In such a case after treatment where only unaided vision is poor, the use of a miotic in this eye is of material help. Near-point tests or visual acuity tests at near with distance correction suggest this possibility of a weak accommodation. The suggested decreased activity in accommodation may be a factor in the results obtained in

the treatment of strabismus. Further study of accommodation in strabismus is indicated.

Whether or not it is more desirable to use miotics rather than glasses in the treatment of some cases of strabismus depends on several factors, not the least of which is our attitude toward glasses. Are we sure that nature does not adjust to the new optical system created with use of glasses? Are we sure such cases do not show less refractive changes (lessening of the ametropia) than the average population? Until we can be certain of this, we cannot say the wearing of glasses has no effect on further refractive changes.

When Brown and Kronfeld[6] reported the finding of increased hyperopia in second atropine refractions, were they actually finding that more hyperopia had been created or that there was more relaxation to the second atropine? Was the wearing of the correction preventing the "hidden hyperopia" from becoming permanently "hidden?" Their thought on this suggests the possibility that the decrease in refractive power of the eye "took place under the influence of the continuous wearing of the full correcting glass. . . ."[6]

Other reasons for not ordering glasses may be the extreme youth of the patient, behavior problems involved with the wearing of glasses, and the psychologic factors as affecting the patients and parents. Cases where coöperation is questionable for any of the above reasons may suffer from lack of care unless other methods can be introduced. Here miotics can play a considerable role.

When it is desired to remove glasses for social or economic reasons, the gradual transition simulated by miotics are much to be preferred to the sudden change produced by removal of the glasses alone.

The consistent results in replacing glasses with miotics in convergent strabismus and the promptness of the results without orthoptics suggest that orthoptic training as advised by T. Davis[7] is not necessary in such cases. Such cases, too, do not need to practice "seeing blurred" by relaxing accommodation. The miotic permits better vision with little or no effort on the patient's part and convergence excess spontaneously disappear in the successful cases.

The miotics, of course, are effective only when used during the waking hours, unless as with D.F.P., the effect carries over to the waking hours when used on retiring. The miotic used, as well as the percentage strength, needs adjustment in each case in relation to the error of refraction and the effect on accommodation. This phase needs further study. To date it has been found that pilocarpine hydrochloride (1-percent solution) is the most desirable drug. However, work with other miotics, especially D.F.P. in 0.05-percent solution, is going forward in an effort to overcome the objections to pilocarpine due to frequent instillations.

Conclusions

There can be little doubt that miotics, if properly used, can become a valuable addition to our armamentarium in the treatment of strabismus, especially after equalization of vision.

The response to miotics in some cases of amblyopia suggests an unsuspected lack of accommodation. Here the miotic may act as a tonic to stimulate the ciliary muscle.

The use of miotics may give one the opportunity to delay or avoid the use of glasses in cases of hyperopia with or without strabismus or anisometropia. The miotic may permit the replacement of the *central* accommodative activity fully or partially for distance *and for near*. The action of the miotic is entirely peripheral.

The thoughts expressed here together with the preliminary presentation of data indicate the desirability for further research.

1930 Wilshire Boulevard (5).

References

1. Key for all tables:

A = alternating or amblyopia
b.m. = before miotic
bid = 2 times daily
C = Convergence
corr = corrected
D = Divergence
D.F.P. = Di-isopropyl fluorophosphate
Eser = Eserine
F = Female or Failed
g = Glasses
H = Helped
Imm = Immediate
L = Left
M = Male
Mi = Miotic
N = None
P = Periodic or Pilocarpine
Prev = Previous
R = Right
Rx = Treatment
Sq = Squint
S = Surgery
Strt = straight
tid = 3 times daily
V.A. = visual acuity
w = with
w.o. = without

Refraction done under atropine or homatropine. No amount of squint given in periodic cases, as this was variable —usually 0° to 45°.

When the miotics are referred to as helping (H), it means that the eyes were straight cosmetically and functionally without glasses.

When the term "cure" is used, it means that the eyes remained straight for at least six months after discontinuance of the miotic and without permanent recourse to glasses.

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Ophthalmic miniature

The essential constituents of the eye are, transparent media to refract the rays of light; a nervous expansion to receive the impression produced by the rays thus refracted; and certain membranous opaque coverings, surrounding, connecting, and protecting the foregoing parts. The eye has been technically described as composed of coats and humors. The coats, tunics or membranes, are the membranous coverings and the nervous expansion; the humors are the transparent media, with the exception of the cornea, which belongs to the coats.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

THE TREATMENT OF GLAUCOMA WITH CYCLODIATHERMY*

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Nonperforating cyclodiathermy was first reported by Weve[1] in 1932. He had noticed, following extensive surface diathermy over the region of the ciliary body for an anterior retinal dialysis, that the tension frequently remained low for some time.

In 1936, Vogt[2] first described the use of perforating cyclodiathermy in glaucoma. In the beginning he used a diathermy needle that was 1-mm. long and 0.2-mm. in diameter and made his punctures 1.5 to 3.5 mm. from the limbus. In a later publication[3] he advised the use of a needle 0.5-mm. long and 0.15 to 0.18 mm. in diameter and stated that the punctures should be placed at least 2.5 mm. from the limbus.

In 1939, Wagner and Richner[4] analyzed the cases from Vogt's clinic and in their description of the technique employed cautioned against approaching closer than 3 mm. to the limbus with the punctures because of the danger of damage to the cornea or lens.

Albaugh and Dunphy,[5] in 1942, reported the results which they obtained after treating 32 cases with cyclodiathermy. Some of the cases were treated with perforating cyclodiathermy, but the majority received nonperforating cyclodiathermy. They found 25 were successfully controlled and 7 were failures over a relatively short follow-up period.

In 1945, Stocker[6] presented his results obtained with cyclodiathermy as an initial procedure in Negroes with chronic simple glaucoma. He advised the use of the shortest type Kronfeld needle or a needle of his own design somewhat similar to the needle employed by Vogt. Stocker reported 17 operations, with the tension improved and within normal limits in 14 cases and with the tension improved but still too high in 3 cases. In the series he reported, the longest period of observation was 10 months.

MATERIAL

Cyclodiathermy was first performed at the Wilmer Institute in 1941 and, from 1941 through 1945, the nonperforating type of operation as described by Albaugh and Dunphy was performed. Since the first part of 1946, the type of cyclodiathermy operation advocated by Stocker has been employed. Because we have used a 0.5-mm. Kronfeld pin and since the sclera is on the average 0.6-mm. thick in the region of the ciliary body, we have named this technique the partial pentrating type of cyclodiathermy operation. This paper deals with the cases of cyclodiathermy performed between 1941 and July, 1947. Sixty-six cyclodiathermy operations on 57 eyes comprise the material for this study. Approximately 60 percent of the operations were nonperforating and 40 percent were of the partial penetrating type.

TECHNIQUE

A Liebel-Flarsheim combination unit which supplies a high-frequency current of approximately a million and a quarter cycles per second was used for all the operations. This machine may be set so as to supply a cutting current, or coagulation current, or a detached retina current which penetrates tissues better than the coagulation current. In general the coagulation current was used during a nonperforating cyclodiathermy operation, while the detached retina current was employed when a partial penetrating operation was performed.

As all other observers have found, the amount of coagulation and penetration produced by a certain setting on the machine varies considerably from one individual to another due to the great variation in individual resistance and to the placement and

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contact of the ground electrode. In almost all of our cases, the power setting was between 10 and 30 units. The power setting is divided into arbitrary units on the Liebel-Flarsheim machine and these units cannot be directly interpreted as milliamperes.

In the nonperforating operation, after the sclera was bared and wiped dry, a 2-mm. flat electrode was applied to the sclera over the ciliary body with the center of the electrode about 4 mm. from the limbus. In one of the early cases the area of cyclodiathermy extended to within 2 mm. of the limbus. This eye developed corneal edema and bullae in the adjacent cornea which persisted for the six months the patient was followed in the clinic.

In the majority of cases one half the globe was treated during an operation and the applications were placed in a single row immediately adjacent to one another. The flat electrode was applied firmly against the globe and contact maintained long enough to produce a slight superficial searing of the sclera. Usually contact was maintained for 4 to 5 seconds and, at the conclusion of the operation, the treated portion of the sclera was a light brown in color.

Due probably to a shrinkage of the treated portion of the sclera, the globe was generally very firm at the end of the operation and, in approximately 85 percent of the cases, a posterior sclerotomy or sclerectomy was performed over the pars plana of the ciliary body to reduce the tension. The conjunctival flap was replaced with either a black silk or plain catgut suture, and the eye was dressed with 1-percent atropine and an eye pad.

After turning down a conjunctival flap, the partial penetrating operation was performed with a 0.5-mm. Kronfeld pin. In the majority of cases, a double row of punctures was made over the ciliary body. The first row was 3 mm. from the limbus and the second row, 5 mm. from the limbus. Each pin was applied for 1 to 2 seconds and the punctures in each row were separated by 1.5 mm. Generally one half the globe was treated and a total of 30 to 40 punctures was done on the average case. With the partial penetrating operation, the tension was less frequently increased during the procedure and a posterior sclerectomy was performed in only 33 percent of the cases. The conjunctival flap was replaced and the eye dressed as in the nonperforating operation.

Criteria for study

The criteria for considering a case successfully treated by cyclodiathermy are: (1) The postoperative follow-up should be nine months or longer; (2) the ocular tension as measured by a Schiøtz tonometer should be maintained at or below 30 mm. Hg and the eye should not be in phthisis; (3) the vision should be maintained at approximately the preoperative level.

Cases not meeting these qualifications were considered as unsuccessfully treated regardless of the period of observation.

Results

The results obtained in this series of cases are shown in Table 1. These cases may be subdivided as follows:

I. Cyclodiathermy done as an initial procedure
   a. Nonhemorrhagic glaucoma, 6 eyes
   b. Hemorrhagic glaucoma, 7 eyes

II. Cyclodiathermy operation done as a late secondary operation
   a. Primary glaucoma, 13 eyes
   b. Postoperative glaucoma after cataract operation, 14 eyes
   c. Glaucoma secondary to uveitis, 11 eyes
   d. Congenital glaucoma, 3 eyes
   e. Congenital aniridia, 1 eye
   f. Glaucoma secondary to trauma, 2 eyes

I. Cyclodiathermy as initial operation

All 13 cases on which cyclodiathermy was done as the initial operation were unsuccessful. The details of these cases are:

a. Nonhemorrhagic glaucoma. One eye with absolute glaucoma and another with glaucoma secondary to uveitis went into phthisis postoperatvely.

A baby with congenital glaucoma had both eyes treated with partial penetrating cyclodiathermy. One third of the right eye was treated at the first operation. This was unsuccessful and an additional one quarter of the globe was treated at a second operation. As the tension in the right eye was not controlled following the second cyclodiathermy, filtering operations were undertaken. The left eye had one half the globe treated and, as this was unsuccessful, a trephination was performed. This also failed and cyclodiathermy was again resorted to on a previously untreated quarter of the globe. The tension again rose and a cyclodialysis was done. This too was a failure and the remaining quarter of the globe was finally treated with cyclodiathermy. After the third cyclodiathermy operation, the tension still was not adequately controlled.

The remaining two eyes of the initial procedure group both had advanced chronic congestive glaucoma. One was treated with nonperforating, while the other was treated with partial penetrating cyclodiathermy. In both eyes, the tension remained in the preoperative range although the eye with tension of around 60 mm. Hg was not painful for the short follow-up period of two months.

b. Hemorrhagic glaucoma. Seven eyes with advanced hemorrhagic glaucoma were treated with cyclodiathermy. Six of these eyes went into phthisis. In the other eye, the tension remained elevated and the eye was so painful that a retrobulbar alcohol injection was required. Phthisis is a common sequela of cyclodiathermy in hemorrhagic glaucoma and apparently was observed by deRoetth[7] in both eyes of each of the two cases which he reported.

TABLE 1

RESULTS OBTAINED WITH CYCLODIATHERMY TREATMENT OF GLAUCOMA

	Type of Glaucoma	Number of Eyes	Tension Elevated	Phthisis	Visual Failure	Controlled by Cyclodiathermy
Cyclodiathermy as Initial Glaucoma Operation	Absolute Glaucoma	1	—	1	—	—
	Glaucoma secondary to uveitis	1	—	1	—	—
	Congenital glaucoma	2	2	—	—	—
	Chronic congestive glaucoma	2	2	—	—	—
	Hemorrhagic glaucoma	7	1	6	—	—
Cyclodiathermy as a Late Glaucoma Operation	Primary glaucoma	13	9	2	2	—
	Glaucoma secondary to extraction of congenital or senile cataract	14	13	—	1	—
	Glaucoma secondary to uveitis	11	6	2	—	3
	Congenital glaucoma	3	3	—	—	—
	Congenital aniridia with glaucoma	1	1	—	—	—
	Glaucoma secondary to trauma	2	1	—	—	1
	Total	57	38	12	3	4

II. CYCLODIATHERMY AS LATE SECONDARY OPERATION

In this study the majority of the cyclodiathermy operations were performed upon eyes with either primary or secondary glaucoma uncontrolled by miotics and the usual glaucoma surgery, such as iridectomy, external filtering operations, and cyclodialysis. In some cases a cataract extraction was also performed in an effort to control the glaucoma. The number of operations prior to cyclodiathermy ranged from 1 to 7 in the

individual cases and generally 2 or 3 operations had been attempted at varying intervals before a resort was made to cyclodiathermy. Vision before cyclodiathermy as a rule was around the 20/200 level or less, although an occasional patient had 20/30 vision remaining. The cases now to be discussed all fall into the group in which the glaucoma was not controlled despite previous operations and miotics.

a. Thirteen eyes with primary glaucoma uncontrolled by previous surgery were treated with cyclodiathermy. In eight eyes the tension remained elevated and two eyes went into phthisis. On one additional eye the usual nonperforating operation was performed, and the tension became elevated after one month to the preoperative level of 41 mm. Hg (Schiøtz). During the subsequent three years of observation, however, the tension has been controlled and the vision has remained at the preoperative level of 20/200.

Two eyes of different patients, both of which were treated with the nonperforating type of operation over one half the globe and a posterior sclerectomy, had the tension controlled for four years, but during the second postoperative year visual failure began due to the development of a cataract. In one of these eyes with a vision of 10/200 postoperatively, the vision was reduced to counting fingers at three feet after 2 years and to hand movements 3 years postoperatively despite a tension well within normal limits at all times. The other eye of this same patient had light perception only due to a more advanced glaucoma and the tension was controlled by a filtering operation, yet four years postoperatively this eye had no cataract.

The second eye, in which the tension was controlled but vision failed due to a cataract, had 20/50 vision after the cyclodiathermy. This was reduced to 20/200 after 2 years and to hand movements after 4 years. The other eye of this same case had absolute glaucoma and, despite a markedly elevated tension during the 4 years, the eye did not have a cataract. Furthermore, the cataract was removed and the vision returned to 20/70, showing that the loss of vision in this case was definitely attributable to the cataract.

It would seem in these two cases that the cataract was a late sequela of the cyclodiathermy operation.

b. Fourteen eyes with secondary glaucoma following the removal of a senile or congenital cataract were treated with cyclodiathermy and all were failures. In 13 eyes, the tension was uncontrolled. In one additional eye, in which there was a rupture of the wound with iris and vitreous prolapse on the 8th postoperative day, the tension felt normal to fingers following cyclodiathermy, but the cornea gradually became cloudy some months after the operation and the vision could not be improved beyond finger counting at two feet.

In one of the 13 eyes in which the tension was uncontrolled, the tension remained within normal limits for one year following the usual nonperforating operation. By the 2nd postoperative year, the tension had risen to 40 mm. Hg; by the 6th postoperative year, the tension was still about 40 mm. Hg, in spite of miotics five times a day, and vision was failing.

In another one of the 13 eyes in which the tension was uncontrolled, three partial pentrating cyclodiathermies were done at approximately one-month intervals. In spite of the fact that the region of the ciliary body around the entire globe was treated with a total of about 90 pins, tension was still elevated after the completion of the third operation.

In our cases of glaucoma secondary to cataract extraction and uncontrolled by previous surgery, cyclodiathermy has been unsuccessful. A few authors have reported successes with cyclodiathermy in aphakics. Lutman,[8] for example, using the nonperforating type of operation, found that the tension was controlled in 5 of his 6 cases

with aphakia. His results, however, are not comparable with ours because 2 of his 5 successes had follow-ups of six months or less and in the other 3 cases cyclodiathermy was the first operation performed for the glaucoma.

c. Eleven eyes with glaucoma secondary to uveitis were ultimately treated with cyclodiathermy. In 6 eyes the tension was not controlled and 2 eyes went into phthisis. Three eyes, 2 of which were in the same patient, were successfully treated by cyclodiathermy.

The patient who had bilateral glaucoma secondary to an active uveitis also was found to have late syphilis and received mapharsen twice weekly while her glaucoma was being treated. This patient was admitted to the hospital about one month after her uveitis began and was hospitalized three times over a period of 5 months during which time the uveitis subsided. While in the hospital she had paracenteses, a trephination, and a cyclodialysis to both eyes in addition to her antisyphilitic therapy. During her third admission, the nonperforating type of cyclodiathermy was performed on both eyes. For the past 3½ years her vision has remained constant, tension has been within normal limits, and the uveitis has been inactive.

The third eye, which was successfully treated, suffered from glaucoma secondary to an inactive uveitis that was not controlled by a trephining operation. The partial penetrating operation was done and this eye has been followed for a period of 9 months with a tension of 26 mm. Hg (Schiøtz).

d. Congenital glaucoma. In addition to the case of congenital glaucoma which was treated with cyclodiathermy as a primary procedure, three other eyes with congenital glaucoma received cyclodiathermy after prior surgery had failed. In these cases cyclodiathermy was also unsuccessful.

e. One case of congenital aniridia with secondary glaucoma, which had only one fourth of the globe treated with nonperforating cyclodiathermy, was unsuccessful.

f. Glaucoma secondary to trauma. There were two cases in this group. In one case, the glaucoma developed after a lye burn and cyclodiathermy could not control the tension.

The other case was that of a person who injured her left eye with a fork 2 months prior to being seen at our clinic and was admitted with a healed corneoscleral laceration and secondary glaucoma, left eye. An iridectomy and two cyclodialyses did not control the tension. One half the globe was treated with nonperforating cyclodiathermy followed by a posterior sclerectomy. As this operation did not maintain the intraocular pressure within normal limits, an additional one quarter of the globe was treated in a similar manner one month later. Following the second cyclodiathermy, the tension was controlled and vision was maintained at 20/50 for the two years she was followed in our clinic.

Pathology

Three eyes in our series were enucleated after unsuccessful cyclodiathermy. Two eyes were treated with nonperforating cyclodiathermy. One of them was removed after two weeks because of pain; the other, after one month because the eye had lost light perception. A third eye was removed one month after partial penetrating cyclodiathermy because the eye was still painful and the tension elevated.

In all three eyes, the sclera was scarred in the region of the cyclodiathermy and the pars plana of the ciliary body was atrophied. Both the pigmented and nonpigmented epithelium of the pars plana was disorganized and the pigment was clumped. The ciliary processes, however, appeared normal except for the most posterior of the processes, which in some places showed atrophy.

In the two eyes treated with nonperforating cyclodiathermy, a fresh hemorrhage separated the uveal tract from the sclera. Since in performing cyclodiathermy the limbus must be avoided by at least 2.5 mm. in order to prevent damage to the cornea, it is well

recognized that the treatment actually occurs over the pars plana and not over the processes of the ciliary body. It has been assumed that damage to the pars plana of the ciliary body by diathermy might involve the processes, and microscopic sections showing this to be the case following perforating cyclodiathermy have been presented by Stocker and also by Albaugh and Dunphy. However, our cases show that the processes are not always involved.

Complications

As was mentioned earlier, the intraocular pressure almost invariably rises during nonperforating cyclodiathermy, while in the partial-penetrating type the tension becomes elevated during the operation in approximately half the cases.

A posterior sclerotomy or sclerectomy was done in 85 percent of the nonperforating cases and in 33 percent of the partial-penetrating cases because of the increase in tension.

While either type of cyclodiathermy is being applied, a trace of blood may appear occasionally in the anterior chamber from the iris vessels near the region which is under treatment. Not infrequently, following a posterior sclerectomy, a slight hyphemia may develop or a trace of blood in the anterior chamber may be augmented due to the effect of decompression on already injured vessels. Among our cases there were no serious hyphemias at the time of operation. One case developed an anterior-chamber hemorrhage which filled two thirds of the chamber on the 3rd postoperative day, but this cleared uneventfully.

During the first few postoperative days, the lids are frequently a little swollen and chemosis of the conjunctiva, especially over the region of the diathermy, is present. Edema of the cornea adjacent to the treated area also may be present. The reaction, however, subsides rapidly and the patient is usually discharged about a week or 10 days postoperatively with only mild conjunctival injection and a faintly positive aqueous ray.

The aqueous ray usually becomes negative during the first postoperative month, but occasionally the aqueous ray may remain positive for 2 or 3 months. After the inflammation subsides in the cases with a prolonged postoperative iritis, some iris atrophy with posterior synechias is apparent and an inflammatory membrane may be present in the pupil. In one eye the reaction to a nonperforating operation performed below was so intense that the pupil ultimately was drawn to the limbus at the 6:30-o'clock position.

Corneal anesthesia was present in all of the cases which were tested. Following nonperforating cyclodiathermy, a corneal infiltrate developed in one eye and a bullous keratitis occurred in another eye during the early postoperative course, but both of these complications healed rapidly. In two cases, persistent corneal edema and clouding remained following cyclodiathermy.

Five cases had delayed healing of the conjunctival flap and several of these required approximately one month before the conjunctival wound was finally healed. Scleral necrosis occurred once in our series and two months passed before scar tissue completely closed the scleral defect. In this case, although sufficient nonperforating diathermy to cause scleral necrosis was used, the tension was not controlled.

To determine whether cyclodiathermy produced any cataracts in our series is difficult because most of the eyes had far-advanced glaucoma, as well as having had previous surgery. Both of these factors may enter into the production of a cataract. However, in two cases already described under the results obtained in primary glaucoma uncontrolled by previous surgery, it seemed as if cyclodiathermy might be directly responsible for the cataract that developed during the 2nd postoperative year.

A case with bilateral congenital glaucoma, uncontrolled by previous surgery or by cyclodiathermy, developed bilateral cataracts

one year after the diathermy operation. However, because of the elevated tension and the possibility of eyes with congenital glaucoma developing cataracts with or without surgery, it cannot be definitely stated that the cataracts in this case were secondary to cyclodiathermy. Cataracts, of course, occur in the phthisical eyes. The clouding of the lens in these cases, however, may be directly due to the degeneration of the eye and only indirectly due to cyclodiathermy.

Summary

Excluding the cases of hemorrhagic glaucoma 4 eyes out of 50 maintained their preoperative vision and had their tension controlled for nine months or longer following cyclodiathermy. Three of these eyes were treated with nonperforating and one with partial penetrating cyclodiathermy. These results are somewhat vitiated by the fact that two of the successfully treated eyes were suffering from an active uveitis which subsided while the secondary glaucoma was being treated surgically and neither eye showed any glaucomatous cupping of the disc.

In addition to the four eyes successfully treated, two eyes had the tension controlled by nonperforating cyclodiathermy, but vision failed due to the development of a cataract. One other eye maintained its vision and the tension was controlled for three years following a nonperforating cyclodiathermy except that the tension one month postoperatively was found to be 41 mm. Hg (Schiøtz).

Twelve eyes out of the entire series went into phthisis and six of the phthisical eyes occurred in cases with hemorrhagic glaucoma.

In the majority of the unsuccessful cases, the postcyclodiathermy tension remained within the same range that it was preoperatively, and the eyes were not painful either pre- or postoperatively. As a rule, if the intraocular pressure was unsuccessfully controlled by cyclodiathermy, the tension became elevated again by the 3rd postoperative month, although in three cases the tension was controlled for one year before it finally became elevated.

In seven eyes that were painful because of a high tension prior to cyclodiathermy, the tension remained markedly elevated postoperatively. In two of the eyes, the pain was apparently controlled by cyclodiathermy; in five eyes, pain was still present.

Conclusion

Theoretically, since cyclodiathermy produces atrophy of the ciliary body it should decrease the formation of aqueous. The operation, therefore, should be beneficial in those eyes in which the normal filtration mechanism has been occluded and in which supplementary filtration cannot be established. Our clinical experience, however, would indicate that the chronic glaucoma which is intractable to miotics and the usual glaucoma surgery rarely can be controlled by either the nonperforating type or the partial-penetrating type of cyclodiathermy operation that we have employed.

The Johns Hopkins Hospital (5).

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COPPER WITHIN THE EYE

With the Report of a Case of Typical Sunflower Cataract of the Right Eye and Copper Cataract Involving the Posterior Capsule of the Left Eye

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The subject of copper within the eye is one about which, although observed and discussed since 1895 (Goldzieher[4]), many ambiguities exist. For example, not infrequently one reads about the apparent toxicity of copper within the eye and again one reads about its innocuousness even to the extent that it disappears through self absorption and extrusion.

Toxicity of copper

A better understanding as to why there is such a variance of opinion regarding the toxicity of copper within the eye can be acquired by reviewing a report of copper within the eye written by Bellows,[1] who cites the experiments of Leber.[6]

In these experiments a much more intense inflammatory reaction was shown to occur in rabbits' vitreous following the insertion of pure copper than when a copper alloy was inserted. This experimental observation was borne out during World War I when, because of the shortage of copper, alloys were substituted. As a result of the use of these alloys, copper cataract was a common occurrence; whereas, the severe reaction which follows intraocular penetration of pure copper was observed infrequently.

Of course, the percentage of copper in the alloy is not the only factor that determines the type of reaction. Both the size and location of the metal are also of great importance. This is clearly exemplified in our case report.

Jess[5] was able to demonstrate that copper was deposited much earlier upon the lens than upon the cornea. Weiss[12] noted that copper deposition within the cornea was greatly accelerated in an aphakic eye.

In H. Müller's[7] very interesting case report of copper in the vitreous, a very tiny particle was present just behind the lens. The cornea developed the characteristic change of greenish blue color. The anterior surface of the lens showed no changes characteristic of copper; whereas, the posterior capsule showed a strong coloration. "The whole structure in direct light appeared to be a golden yellow color and in other illumination of blue-green color."

The author stated that normally the anterior lens is the seat of the opacification but since in this case the concentration of copper was extremely small and since the copper was very close to the posterior capsule, it could be assumed that the coloration might develop in the posterior capsule.

As far as Müller was able to determine this was the only case reported in which the posterior rather than the anterior capsule was involved. In the case herein reported, copper particles were deposited in the anterior capsule in one eye and in the posterior capsule in the second eye. Such specific localizations is by no means accidental. It is my aim to attempt to explain this variation in localization.

Description of sunflower cataract

The sunflower or "Sonnenblumenstar" is a delicate greenish-gray opacity occupying the pupillary area of the lens. Bellows describes the opacity as having a delicate, velvetlike surface in which round clear spots are scattered. Upon dilatation there is seen radiating opacities diverging from the periphery of the disc and disappearing as they approach the equator. With higher magnification gray-white, blue, and green dots are seen over the entire surface of the anterior lens. These opacities lie at or in the

immediate vicinity of the posterior surface of the anterior lens capsule.

Purtscher,[9] who first described the sunflower cataract, stated that it was a grayish-green opacity of circular form occupying the pupillary area upon the anterior capsular surface and sending out petallike prolongations to the periphery of the lens. With oblique light this opacity takes on all the colors of the rainbow; the iridescent nature of the deposit is well visualized in the zone of specular reflection.

As long ago as 1918 Pilcher[8] stated that the color display from the anterior capsule was the only important diagnostic sign in chalcosis. Later he read Vogt's[11] report in which the characteristic red-greenish color of the opacity was described.

Manifestations of chalcosis

Both Jess and Vogt have established the fact that when copper alloy is lodged in the anterior section of the eye chalcosis may manifest itself in one of the following forms: (1) A greenish-blue ring in the peripheral corneal structures within Bowman's membrane and the endothelium. (2) a sunflower cataract in the anterior portion of the lens; (3) impregnation of the zonular fibers with copper particles.

When the copper fragment is present in the posterior part of the globe other characteristic changes occur: (1) A brilliant grayish-green deposit upon the vitreous framework with a breakdown in its structure; (2) metallic deposits in the retina and upon the surface of the retinal blood vessels. These are brilliant and highly refractile although later these brilliantly colored areas become darker.

The observation of these retinal changes has been quite rare, only occasional and quite brief reports appearing in the literature.[2]

Characteristics of chalcosis

Vogt listed five characteristics for the pure variety of chalcosis: (1) A disc-shaped ring as wide as the pupil with many radiating spokes producing the sunflower; (2) its color varying from gray-green to olive-green to brown to brownish-red; (3) in reflected light it appears to be a pseudocataract since it is invisible; (4) location of the sunflower in the anterior lens capsule; (5) a lively color display from the anterior shagreen. (These five criteria may be shown to be inconstant.)

The first complete biomicroscopic examination was reported by Vogt in 1919. The changes in this case were present six months after the injury.

"Upon dilatation of the pupil to 7 mm. and using lateral illumination, a greenish-blue ring and identically colored spokes were seen. The disc was 2 mm. in diameter. The spokes were 0.3 to 0.4-mm. broad. The spokes were 0.1-mm. wide at their broadest point. The disc itself was observed about three months after the perforating injury. Some diffuse changes were seen within the ring itself. Under magnification (24×) grayish-white to gray-green blue small thick white spots were visible upon the anterior lens capsule. The rosette figure was so overladen through local thickening that the entire anterior lens capsule appeared to consist of grayish-white spots. The location in depth of the sunflower was shown to be in the region of the capsule stripe. Since the copper particle does not form a permanent compound with the cell protein, regression of copper deposits may take place."

Case report

History. The patient was involved in an explosion of a projection sound box on August 21, 1944. He stated that his left side was exposed to the direct line of the projector and that multiple foreign bodies lodged in his chest and neck and in the vicinity of his left eye. At the onset there was no visual impairment.

Eye examination. On October 16, 1944, I examined this patient and made a diagnosis of chalcosis of the vitreous, left eye. X ray of this eye failed to reveal any intraocular foreign body, although with the bone-free technique of Comberg, I was able to locate a foreign body on the nasal sclera of the left eye. This minute foreign body was removed on October 23.

No penetration of the eyeball could be uncovered. The nasal portion of the left eye showed a marked vitreous turbidity, suggestive of coppering of the vitreous, through which a yellowish-white screen could be seen in the area between the 8- and 11-o'clock positions in the extreme periphery.

Two weeks later the vitreous had cleared somewhat and I now could see an area resembling a large tentlike retinal detachment between the 8- and 11-o'clock positions with a red oval hole present on each side at the base of this tent in the extreme periphery. The top of the tent was drawn out into a vitreous band which was attached to a large vertically oval choroidal pigmented lesion almost as large as the disc in size and located temporally and slightly below the macula.

Fig. 1 (Rosen). Chalcosis lentis.

Repeated X-ray and biomicroscopic studies failed to reveal any intraocular foreign body, or any evidence of the characteristic "sunflower."

Treatment. From the clinical appearance I had no doubt that we were dealing with an alloy of copper and therefore instituted a line of treatment suggested by H. Müller, consisting of intravenous therapy of sodium thiosulfate. The patient was given some 12 to 14 injections of sodium thiosulfate without any apparent change in the appearance of the left eye. His vision still could be corrected to 20/20 and although there was no evidence of further disturbance of the vitreous body, there was also no indication that we were getting anywhere with this treatment.

In December, 1944, the patient complained of an opacity in front of his right eye, and at this time I uncovered a characteristic sunflower cataract in this right eye. Upon further examination of this eye a small fragment of copper was found in the right vitreous approximately one-fourth disc diameter in size.

The thiosulfate therapy was increased, being given not only intravenously, but locally in the form of drops, eye baths, and ointment. A course of glycocol was administered systemically, according to the suggestion of Jess, who has shown that the breakdown of amino acids has a decided action upon the vitreous copper condensation. The patient was given 40 injections of thiosulfate.

The interesting phenomenon of the appearance of a sunflower cataract in the right eye, where the foreign body was located in the vitreous, and of the failure of a similar lesion to develop in the left eye, where the foreign body was probably present posterior to the retina and, in this manner, sealed off or unable to reach the capsule of the lens in an ionized form, seemed to be an unusual observation. There is no doubt that chalcosis vitreous existed in the left eye; whereas chalcosis lentis existed in the right eye.

Course. On June 17, 1947, the patient was reëxamined and the following notation was made.

RIGHT EYE. There is no indication of copper in the cornea. The iris has shown no color mutation. The sunflower is now much denser than upon the previous examination, being much more greenish-yellow. The disc within the center of the sunflower, which portion was previously uninvolved, now is covered by the same iridescent stippled deposit.

The petals of the sunflower are broader and the periphery of each petal is now flat instead of being pointed. The diameter of the central disc is definitely smaller than the pupillary diameter.

In the zone of specular reflection the deposit is seen to be made up of minute polychromatic granules which change their sheen as the light varies in its direction. There is no bridging of the periphery of the petals by this same deposit.

Upon the posterior capsule of the lens a peculiar complicated cataract is developing which is at present round, brown, and about 2 mm. in diameter. It contains three smaller darker areas in its spiderweblike structure.

The vitreous has shown an increased degeneration. The framework is now bluish green in color with a pronounced sheen. There are many optically empty spaces within the normal horizontally undulant, gossamer-curtain appearance of the vitreous body.

Careful search of the fundus, particularly the vessels, fails to show any deposit of copper along the course of, or upon the surface of, the blood vessels.

In the right macula a strange reflex is seen, sort of a small gold ring surrounding the macula lutea with the entire macular region appearing to be "ironed out."

LEFT EYE. The retina has apparently undergone complete healing. In the extreme periphery at the 10- to 12-o'clock meridian there are two old, large, healed choroiditic scars probably the remains of the double tentlike structure already described.

Slightly nasalward there is a pigmented choroidal crescentic tear with two knobs at its extremities. The vitreous appears to be normal. The posterior capsule has a very definite greenish-gray sheen with its color being similar to that of the originally described sunflower in the other eye.

The posterior capsular deposit has an iridescence and can be broken down into the most minute of small granules. The individual granules are definitely smaller in this capsular mass than are the elemental granules in the anterior capsular deposit of the right eye. This size difference I believe is of importance in explaining the formation of the chalcosis in each eye and its localization in the different capsules and I shall presently attempt to explain this difference of localization.

In the left eye there is no suggestion of a sunflower cataract. Seven or eight radiations are apparent upon the postcapsule much after the pattern of the secondary sutural lens system. There is no other indication of copper deposit elsewhere in the eye.

DISCUSSION

Experiments by Itoi, Kohlrausch, and Mielke have demonstrated that the cornea acts as an anode and that the retina acts as a cathode with a constant current passing posteroanteriorly in the eye.

An intraocular foreign body ionizes and its particles flow in this current toward the anode. Any breaks in the surface may allow deposition of these metallic ions. Experimentally, cracks and crevices may become impregnated with these metallic particles. Such a deposition is the forerunner of the sunflower cataract.

Mielke (cited by Bellows) has shown that all border surfaces in the eye are ideal for the gathering of copper particles. Besides this electrochemical conduction, diffusion of ions must be a factor since copper particles are known to occur posterior to the site of the foreign copper substance; that is, the presence of copper in the retina in cases where the copper lodges in the center of the vitreous.

In the case report herein presented, it is interesting to note that, in the right eye, the process of chalcosis proceeded in the customary fashion. A foreign body of copper lodged in the vitreous and after three months, a typical and characteristic sunflower cataract appeared in the anterior capsule of the lens.

Later this opacity became more intense,

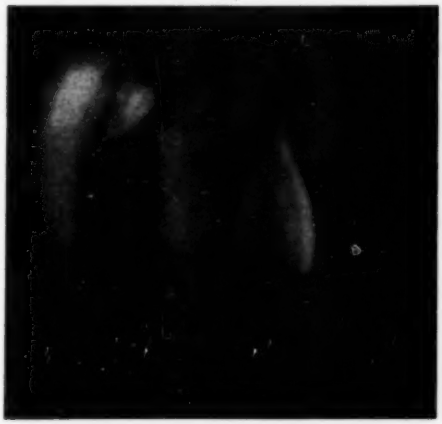

Fig. 2 (Rosen). Slitlamp photograph showing the intensification of the beam upon the posterior capsular surface.

chalcosis of the vitreous developed, and a complicated cataract appeared posteriorly. Simultaneously the thin leaf of copper was absorbed. In this right eye the process of chalcosis oculi proceeded as anticipated and there were no unusual findings.

In the left eye, after several months an iridescence was observed upon the posterior capsule of the lens. This was much like the polychromatic luster seen in a complicated cataract. Then followed a very unusual deposition of microscopic particles upon the posterior lens capsule.

Müller, in his article, stated that he had seen no previous reports in the literature of copper being deposited upon the posterior capsule of the lens. This, therefore, is the second case of copper deposition in the posterior capsule to be reported.

In the left eye, the deposit was made up of much finer particles than in the anterior capsule of the right lens.

It would appear that, in the left eye, the minute copper particle had been walled off by the retina and inflammatory elements, although not completely. It may be assumed that very tiny elements of copper passed through the retina-vitreous barrier to become deposited upon the posterior capsule. The size of these particles and the weakness of the electrochemical current within the eye may have been the factors which predetermined the site of deposition of the copper.

In any event, this observation would tend to support the theory that the iris pattern determines the morphology of the sunflower —for it is quite evident that copper deposition upon the posterior capsule in no wise resembles a sunflower. Up to the present time there has been no evidence whatsoever of any anterior capsular deposition in the case herein reported.

In 1935 Cordes and Harrington[3] reported a case of bilateral absorption of copper with chalcosis lentis in one eye. Cordes believed this phenomenon to be extremely rare, thus warranting the report of the case. He stressed the point that absorption of the copper is more likely than extrusion, particularly if the copper is present in the form of an alloy and if the copper is in small fragments.

Many authors have shown that the prognosis is poor if the copper is pure; whereas, in the case of an alloy of copper the prognosis may be somewhat better. Older writers portrayed a much more serious outcome in cases of intraocular copper but, with the increased frequency of retained copper alloy, the prognosis has been shown to be somewhat improved.

In the article by Cordes and Harrington, a statement is made that the characteristic picture of chalcosis begins to appear, as a rule, several years after the introduction of the foreign body. This statement has caused some men to believe that several years are required for the development of chalcosis (Sudranski[10]). On the contrary, it would seem that the development of chalcosis depends upon the size and nature of the copper alloy and its location within the eye rather that upon the length of time the copper foreign body has been present. I have seen chalcosis develop within a few months in several cases, and I have tried to show why the time of development of the sunflower cataract is variable.

Summary

A case is reported in which there occurred a typical sunflower cataract in the right eye and a type of copper cataract involving the posterior lens capsule in the left eye. As far as could be learned from a review of the literature, this is the second such case reported.

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A UNIVERSAL TYPE INTEGRATED IMPLANT

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Since the publication of Ruedemann's[1] paper, considerable interest has centered on the possibility of attaining the advantages of his procedure and still have a prosthesis that can be altered or adjusted at will. This has resulted in the term "integrated implant," probably first used by Hughes.[2] It is not the purpose of this paper to discuss the various implants that have been developed; these will be presented in forthcoming articles by others.[3]

The objectives to be strived for in an ideal implant and prosthesis are: (1) A wide range of movement; (2) instantaneous movement over the short ranges; (3) absence of sinking in of the upper lid; (4) absence of sagging of the lower lid; (5) permanence.

The first four of these objectives are obtained by an integrated implant; the last has yet to be determined. Five-year statistics will be more revealing than those covering only one or even two years.

In a previous paper[4] I presented a preliminary report on the use of a ball and ring type of integrated implant. It was realized that the fixation of the implant by means of suturing the tissues to the ring offered some difficulty and that slight misplacement of sutures would result in the implant later being extruded. Consequently, a simpler procedure and a larger area for fixation of tissue to the implant appeared to be desirable.

The use of tantalum mesh on the surface of the implant, first by Ruedemann,[1] seemed to answer the problem. Further simplification has been achieved by having one standard-size implant for use in enucleation, in reimplantation, and in eviscero-enucleation. The latter is presented herein as a new operative procedure.

DESCRIPTION OF IMPLANT

The implant used (fig. 1) is made of methyl methacrylate and consists of a ball measuring 18 mm. in diameter and 15 mm. deep. On the anterior surface is a raised area, 11 mm. in diameter and 1 mm. deep. The anteroposterior length of the implant is, therefore, 16 mm.

The anterior convex surface of the implant is covered with double tantalum mesh.

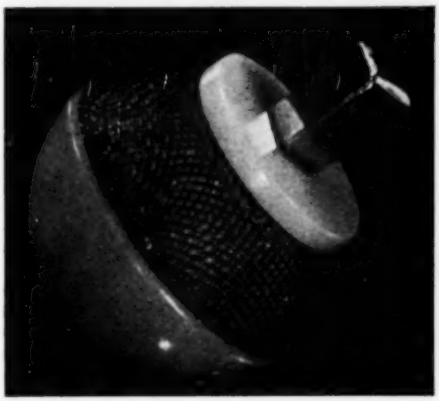

Fig. 1 (Cutler). A universal type integrated implant.

Under the mesh, 1½ mm. from the anterior edge, is a groove in the plastic to permit the suture needles to be readily passed through the mesh.

It is felt that an implant of approximately this size replaces the necessary amount of volume lost in removal of the globe and gives the normal center of rotation for the prosthesis. A larger implant may impose difficulties in fitting the eye, since approximately 5 mm. have to be allowed for the iris button and fixation of the pin.

Plastic was used for the implant because of convenience and not because it is neces-

sarily the most desirable substance. It is quite probable that an implant made entirely of tantalum, or some other metal, might be better.

Operative techniques

Reimplantation following simple enucleation

Two purposes may be served by reimplantations in old sockets: (1) If no previous implant has been used, the socket is filled out, and (2) any movement that is in the socket can be transmitted to the artificial eye.

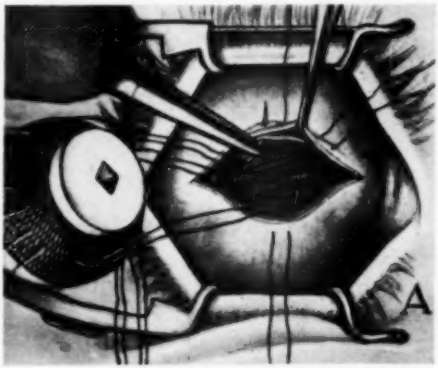

Fig. 2 (Cutler). Reimplantation A. Sutures are passed through cut edge of Tenon's capsule and conjunctiva.

Operation. The anesthesia may be local or general. If muscle dissection is going to be done, a local anesthetic is used.

A horizontal incision is made through the conjunctiva and carried through the underlying tissue (fig. 2), the tissues being spread with Stevens scissors. In this manner the smooth inner surface of Tenon's capsule can be found. This space is then opened widely by spreading the scissors, care being taken to open up well into the socket behind. It must be realized that adequate space can be obtained posteriorly, and that Tenon's capsule is useful primarily on the anterior surface of the implant.

From 4 to 6 double-armed 3-0 or 4-0 catgut or silk sutures are passed through 2 or 3 strands of the tantalum mesh in the region of the groove. The implant is then placed in the socket and the sutures brought out through Tenon's capsule and the conjunctiva (fig. 3). These sutures are brought out allowing about 1½ to 2 mm. of excess tissue anteriorly. This tissue will retract later.

A conformer with a round pin attached is placed in the socket; the pin fits loosely into the implant. An adhesive dressing and roller bandage are used and left in place 6 or 7 days. An adhesive dressing may be used for an additional 2 days. The eye is fitted in approximately 3 weeks.

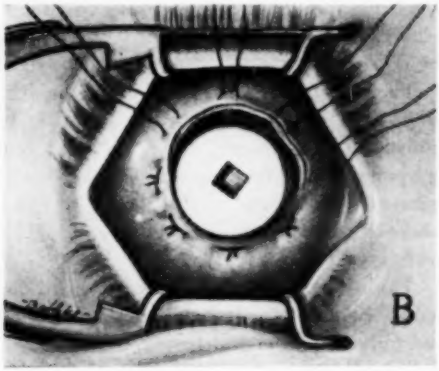

Fig. 3 (Cutler). Reimplantation B. Implant in place.

Reimplantation in socket with previous ball implant

This procedure is similar throughout to that of reimplantation following simple enucleation except that Tenon's capsule is already defined although it has to be opened posteriorly with scissors to allow it to contain the larger size implant.

Operation. Either local or general anesthesia is used. The conjunctiva is incised and freed from the limbus, and the dissection is carried to the fornices in the usual manner. The rectus muscles are isolated and,

before being cut free, an identifying medium silk suture is passed through the tendon. The optic nerve is then cut and the enucleation completed.

The implant, which has had 8 equally spaced 3-0 double-armed catgut or silk sutures placed in the mesh is placed in the socket (fig. 4). The needles of the four sutures which correspond to the four quadrants and are opposite the recti, are then passed through a firm part of the anterior edge of Tenon's capsule through the muscle tendons and out through the conjunctiva

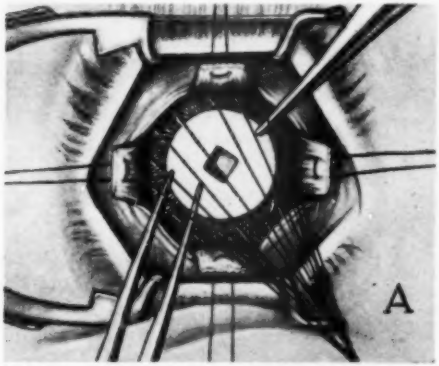

Fig. 4 (Cutler). Enucleation A. Implant in place.

about 2 to 3 mm. from its edge. After the four recti muscles have been sutured, the alternate sutures are brought out through Tenon's capsule and the conjunctiva only (fig. 5). All sutures are tied and cut as they are placed.

A conformer is placed in the socket and an adhesive dressing and roller bandage are applied. This dressing is left on 5 or 6 days with an adhesive dressing for another 2 or 3 days, if necessary. The prosthesis can be fitted in 3 weeks.

Eviscero-enucleation

It was felt that, in so far as an integrated type of implant is concerned, evisceration procedures offered two problems: (1) Fixation of the implant to the sclera, and (2) the prevention of extrusion through shrinkage of the sclera.

If allowance is made for shrinkage of the sclera by using a small implant, then a normal center of rotation of the globe is sacrificed as well as the benefits of a space-filling implant to prevent sinking in of the upper lid.

The eviscero-enucleation procedure is offered as a solution to these two problems. Hall,[5] in 1898, was the first to modify the simple evisceration by removing a disk of

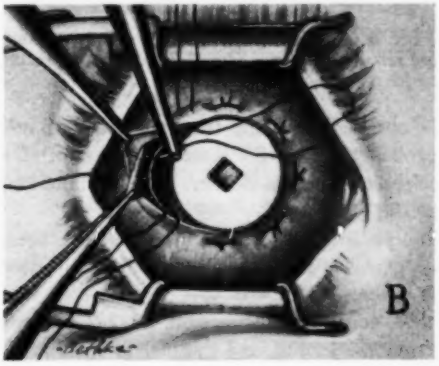

Fig. 5 (Cutler). Enucleation B. Suture being brought out through Tenon's capsule, rectus muscle, and conjunctiva.

the posterior sclera with a piece of the optic nerve.

In the procedure to be described, the entire posterior half of the sclera and a piece of the optic nerve are removed after the cornea has been excised and the globe eviscerated. In this manner a collar of sclera, with the rectus muscles intact and the episclera and conjunctiva undisturbed, is left. The implant is introduced from the back and sutured in place. There is thus an implant 18 mm. in diameter, held in place by the sclera, in which there is a 12 mm. opening (the corneal opening).

Figure 6 shows a diagrammatic representation of the implant in place in the socket. Shrinkage, if it occurs, cannot exert pressure forward on the implant. Fixation

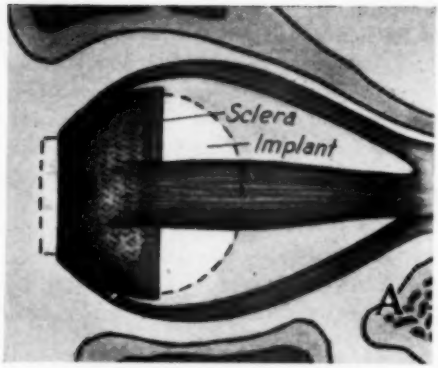

Fig. 6 (Cutler). Evisceration A. Diagram showing relation of implant to scleral collar and rectus muscles.

is obtained through the growth of tissue, probably from the anterior edge of the scleroconjunctival border, into the tantalum mesh.

Operation. Anesthesia may be either local or general; if local, a retrobulbar injection is given.

A conjunctival incision, about 10 mm. from the limbus and parallel to it, is made in the superior temporal quadrant (fig. 7). The lateral and superior rectus are located with muscle hooks. The optic nerve is now felt for with enucleation scissors. If desired, a snare or clamp may be placed on the nerve. Following a cataract incision, the entire cornea is removed and the contents of the globe eviscerated.

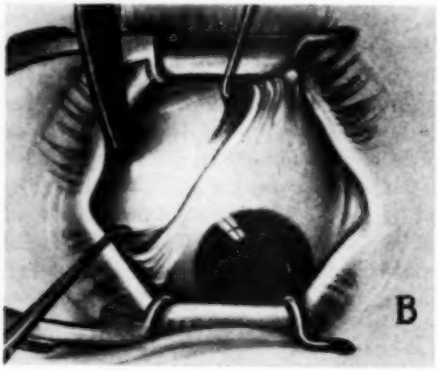

Fig. 7 (Cutler). Evisceration B. Conjunctival incision.

While the assistant holds the lateral and superior rectus muscles on muscle hooks the collapsed sclera is grasped with toothed forceps just back of the line of insertion of the muscles in the equatorial region, and the sclera is incised with scissors (fig. 8). This incision is now carried under each of the muscles.

The posterior cut edge of the sclera is grasped with toothed forceps and, with some traction being made, the enucleation scissors are passed back and the optic nerve is cut.

The posterior half of the globe is now evaginated through the corneal opening. One blade of a Lester forceps is placed on the cut nerve and the other blade on the inner surface of the globe. Using Mayo scissors the scleral incision is continued to excise the posterior half, the oblique muscles being cut (fig. 9).

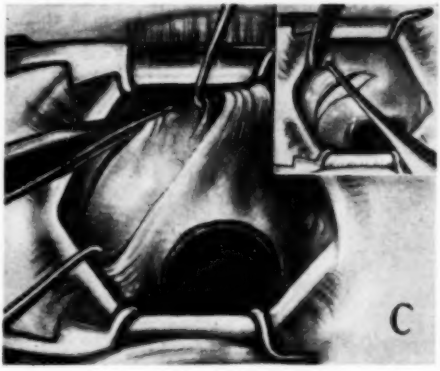

Fig. 8 (Cutler). Evisceration C. Incision in sclera after cornea and contents of globe have been removed. Inset shows cutting of optic nerve.

The remaining anterior collar of sclera is inspected and any irregular edges are trimmed.

Four (originally 8 sutures were used) 3-0 double-armed catgut sutures are spaced in the four quadrants of the universal implant and carried through the mesh in the region of the groove. These sutures are

pulled through the sclera collar, through the posterior opening, and out through the corneal opening. The implant is then also pulled through from behind (fig. 10). The small raised collar of the implant now projects

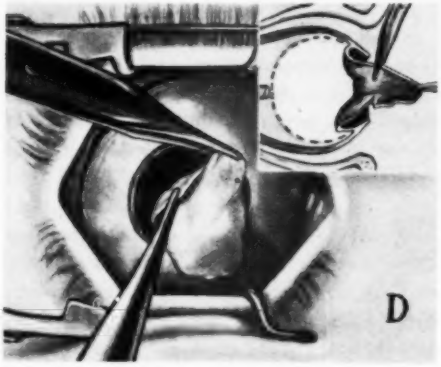

Fig. 9 (Cutler). Evisceration D. Posterior half of globe evaginated through corneal opening and excised.

through and exactly fills the corneal opening. The four double-armed catgut sutures are brought out through the sclera, about 1.5 mm. from the anterior cut edge, tied and cut (fig. 11).

A plastic conformer is placed with the pin in the implant opening and sulfathiazole ointment is applied. An adhesive dressing and roller bandage are used. The dressing is changed in 6 days and, if desired, an adhesive dressing may be used for 2 more days. After 3 weeks, the eye is fitted.

There is likely to be more edema following this procedure than following an enucleation but not as much as is sometimes present following a Mule's operation. It is also usual for the patient to wish to keep the other eye closed and quiet for 2 to 3 days because of muscle soreness and edema in the socket.

The movement of the implant is probably as nearly perfect as can be obtained. After the eye is fitted, it is usual to get better and more consistent movement temporally than is obtained in enucleations. The horizontal

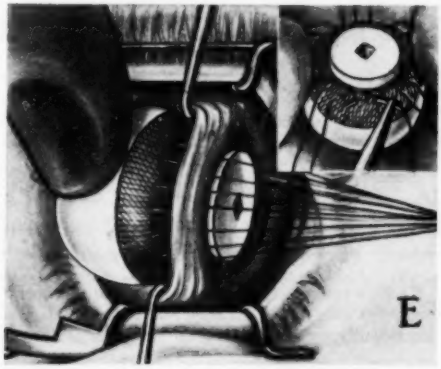

Fig. 10 (Cutler). Evisceration E. Implant introduced from behind scleral collar.

movement averages 65 to 70 degrees and the vertical 65 degrees, about the same as is obtained with the ball and ring implant and somewhat greater than is obtained in enucleation using the same type implant. The slightly less movement in enucleations seems to be due to the very firm adhesion of the tissue to the mesh which causes some limitation, not evident in eviscero-enucleation.

An example of the fine movement obtained in eviscero-enucleation was seen in the second patient operated on who had a congenital nystagmus. The nystagmus was present in the artificial eye.

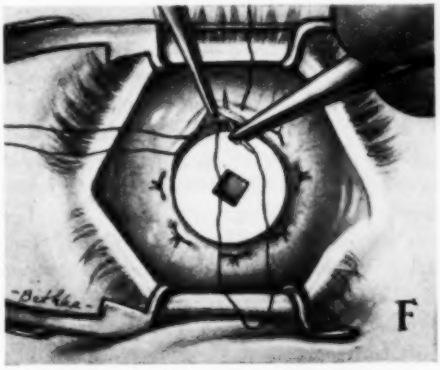

Fig. 11 (Cutler). Evisceration F. Completion of sutures through scleral collar and of conjunctival opening in upper quadrant.

TABLE 1

RESULTS OF USE OF UNIVERSAL IMPLANT OVER A 16-MONTH PERIOD

Type of Operation	No. Cases	Extrusions
Eviscero-Enucleation	26	0
Enucleation	13	0
Reimplantation	10	1*
TOTAL	49	1*

* One implant was removed one week postoperatively because of hemorrhage and infection. It was successfully reimplanted two months later.

Postoperative result. Table 1 presents a summary of the cases operated by me and by ophthalmologists who have become familiar with the procedure. The maximum length of time since operation is 20 months.

SUMMARY

A ball and mesh implant for use in enucleation, in reimplantation, and in eviscero-enucleation is described. The latter is presented as a new procedure. A summary of its use in 43 cases is presented.

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OPHTHALMIC MINIATURE

The Greeks, the Romans, and the Arabians were ignorant of anatomy, and could not, therefore, be acquainted with the essential nature of disease, that is, the altered structure of the organs; nor connect with those changes, which really constitute disease, their appropriate external signs or symptoms. This disadvantage, however, is not so great in diseases of the eye as in many other affections, because most of them are externally visible, and obvious enough without anatomical knowledge. Hence the Greeks, who were good observers of nature, had noticed many forms of ophthalmic disease, in many instances described them well and distinguished them accurately. The extent of their knowledge is evidenced by the imperishable records of language; for many of the diseases still bear the names given them by the Greek writers.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

NOTES, CASES, INSTRUMENTS

BILATERAL BLOOD STAINING OF THE CORNEA*

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Although blood staining of the cornea has been recognized as an entity since 1875[1] and is fairly common, relatively few cases have been reviewed in the literature. Moreover, nearly all the reports omit any description of accompanying changes in the other structures of the injured eyes. The case herein presented is deemed noteworthy because bilateral involvement is extremely rare (only one other report of such a case, that of Dr. Gradle,[2] has been found) and because the functional outcome was surprisingly good.

REPORT OF A CASE

History. L. C., aged 27 years, had had no trouble with his eyes until he was struck across the bridge of his nose by a large tree limb while driving a tractor on March 9, 1939. There was an immediate loss of vision accompanied by severe pain in both eyes. The eyes were said "to have been filled with blood and bulging so that the lids could not close." Vomiting occurred several times during the next few days. The pain gradually subsided as did the intense swelling of the lids and bulbar conjunctiva.

Eye examination. The patient was first seen in the Department of Ophthalmology of the Indiana University Hospitals seven weeks after his injury. A marked blepharospasm occasioned by severe photophobia made examination difficult. There was a definite reddish brown stain of both corneas which, together with the dark red blood in the anterior chambers, prevented any view of either iris. Ciliary injection was marked. Vision was diminished to light perception. Hot compresses, dionin, and atropine were prescribed by the staff physicians. Goggles were substituted for the heavy eyepads and a black ring mask which the patient had worn following the injury.

Within a short time the intense photophobia improved. Ten days after admission the patient was able to walk around the room and could distinguish bright colors. A great part of the hyphemia had been absorbed, leaving the red-brown corneal stain more evident.

Ten weeks after the injury, the visual acuity of the right eye was 20/200, while that of the left was 20/65. Six weeks later vision in the left eye had improved to 20/25−3. Intraocular pressure, as measured with the Gradle-Schiøtz tonometer, was 20 mm. Hg in each eye and has remained within normal limits.

By October, 1939, the corneal stain had faded and cleared enough to permit observation of the underlying structures. The irides, originally brown, appeared grayish blue and were markedly atrophic. The normal elevations were flattened except in several small sharply defined areas. These were of a deeper blue color. At the edges of these patches were radial openings which allowed drainage from the posterior to the anterior chambers, thereby explaining the absence of an iris bombé. A bluish gray exudate covered the pupillary area and appeared to bind the iris in its entire pupillary circumference to the lens. The right pupil was oval and 4 to 5 mm. in diameter. The left pupil could not be defined. The visual acuity remained stationary. Because the right cornea appeared much clearer than the left, which eye had much the better acuity, peripheral field studies were made with an ophthalmoscope bulb as target. They were full.

Four months later the clear area about the edge of the cornea had widened. The stain

* From the Department of Ophthalmology, Indiana University School of Medicine.

itself had changed to a bluish green color. Slitlamp examination revealed the deposition of many tiny brown flecks on the iris surface. The lenses were described as having grossly a ground-glass appearance.

In September, 1941, 2 years and 6 months after the onset, both corneas appeared grossly to be free from stain. However, the corneal microscope showed a faint haze throughout. At that time, some vascularization in the deeper layers of the substantia propria of the right cornea was first seen.

In November, 1943, the visual acuity was 20/200 in the right eye and 20/50−2 in the left. Dustlike, nonpigmented deposits could be seen on the endothelial surfaces of the cornea by using the high power of the corneal microscope. Although the lenses still appeared grossly gray, the fundi could be seen surprisingly well. The discs appeared slightly pale and the lamina cribrosa was very prominent. Manifest refraction was: O.D., −2.5D. sph. ⌒ +4.5D. cyl. ax. 75° = 20/30; O.S., −2.0D. sph. ⌒ + 2.5D. cyl. ax. 122° = 20/25. With a +2.5D. addition, J2 could be read easily.

Six months later, the vascularization of the right cornea had extended almost around the entire periphery but the pupillary area remained free. The left eye showed only a few vessels encroaching on the cornea. Some of the iris vessels were so dilated as to be visible. A few punctiform opacities were noted in the cortex of both lenses.

In July, 1944, the only change noted was an accentuation of the suture lines of the lenses and some increase in the extent of the vascularization of the cornea.

When the patient was last seen on December 20, 1946, almost seven years after the injury, the uncorrected visual acuity was: O.D., 20/80; O.S., 20/50. Correction gave an improvement to: O.D., 20/40; O.S., 20/30. With a +2.5D. addition, 0.75M and 0.62M print were easily read with the right and left eyes, respectively. The upper three fourths of the right iris had acquired a brown color. The lower one fourth and the entire left iris remained a gray blue.

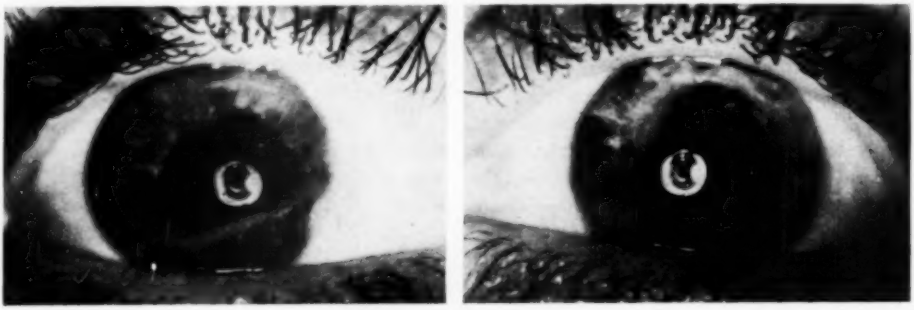

Fig. 1 (Norris). Clearing of the blood staining in both eyes. The picture was taken on July 28, 1944, five years and four months after the injury.

The right iris showed some normal radial furrows while the left iris had very few. It was impossible to identify the pupillary margin. No details suggestive of the collarette or frill of either could be seen. The small openings in the iris continued to allow drainage from the posterior to the anterior chambers.

The corneal vascularization and appearance of the discs remained the same. Visual-field studies on the perimeter and tangent screen, using a 5-mm. white test object at 330 and 1,000 mm., were normal.

Discussion

The exact mechanism whereby blood staining is produced in the cornea is still a moot question. Most authorities are agreed that two conditions must be present for development of the discoloration; namely, blood in the anterior chamber and increased intraocular pressure.

In section many brightly refractile bodies are often found scattered through the lamellae and between Bowman's membrane and the epithelium. They have been variously described as consisting of fibrin coagulum, micro-organisms, globulin masses, hemoglobin, hematoidin, and hemosiderin. Whether they arrive through the spaces of Fontana or through Descemet's membrane is still a matter of conjecture.

Wood[3] believed that diffusion through an intact Descemet's membrane would be impossible. He stated that if, on the other hand, the endothelium were damaged, one would expect irregular staining. This does not occur. He also pointed out the fact that pigment cells from a melanotic tumor of the iris have been known to enter the spaces of Fontana and, therefore, favored that pathway.

All blood-stained corneas eventually clear, although they may require more than two years to do so. Many of the injured eyes which develop blood staining must be removed because of the accompanying severe pain due to the elevated intraocular pressure. About a third of the reported cases ended in enucleation. Rychener,[4] in his article on the management of traumatic hyphemia, stated that useful vision is seldom achieved.

Summary

A case of bilateral blood staining of the cornea has been presented almost seven years after injury. The corrected acuity was: O.D., 20/40; O.S., 20/30.

The progress of the clearing, as well as the accompanying iris and lens changes, have been described.

404 Hume Mansur Building (4).

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IRIDOSCHISIS

A case report

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The separation of the iris into two layers, an anterior and a posterior, is an extreme rarity. No case could be found in the literature where there was a complete separation of the entire iris into two distinct layers.

Gala,[1] in 1941, reported a case of bilateral avulsion and splintering of the anterior layer of the iris stroma in a patient who also had a typical glassblower's cataract. Only the lower portions of the irides were involved. The detachment of the anterior leaf of the iris stroma was attributed by Gala to senile changes.

Loewenstein and Foster,[2] in 1945, found eight recorded cases of partial separation of the iris, and added one of their own. They described the condition as a local division of the stroma into two layers, the distal portion of the anterior layer floating freely in the aqueous. The authors quoted Sanders' description of the iris in each case, "looked as if teased by a crochet needle." Their proposed term for the condition was "iridoschisis."

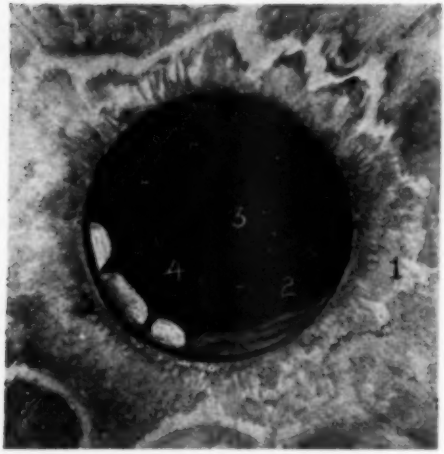

Fig. 1 (Veirs). Separation of the iris into two layers. (1) Dilated anterior layer of iris. (2) Posterior, or pigment, layer of iris. (3) Pupil of pigment layer of iris with fibers of vitreous. (4) Rents in pigmented layer. (5) Ridged strands of white tissue (lens capsule remnants?).

Case report

History. A 70-year-old man (J. D. S.) stated that his right eye had always been crossed. He believed that his right eye was injured at the age of six years, during a hurricane. He had had no vision in the right eye since the time of the injury, but he thought his vision in this eye was good prior to that time. The right eye was operated upon for crossed eyes in 1927.

Examination revealed vision in the right eye to be light perception; in the left eye it was 20/70, correctible to 20/25. Externally, both irides had a clear, light-blue appearance. The pupils were equal and regular. With an undilated pupil, no light reflex could be seen in the right eye, nor could any of the fundus be seen with an ophthalmoscope.

When the right pupil was dilated, a second iris was seen lying 1 or 2 mm. posteriorly. It had a uniform, brown, granular appearance. An oval-shaped pupil about 2½ mm. in diameter was present, situated nasally to the pupil of the blue, or anterior portion, of the iris. The hyaloid membrane was ruptured, and a small portion of the vitreous was projecting through this second pupil. Two small rents were present in the brown layer, one temporally and one inferiorly.

At the extreme periphery, around its entire circumference, bands of the brown iris appeared to blend with the blue portion at its attachment to the ciliary body. These bands appeared to run almost directly posteriorly for a distance of 1½ to 2 mm., at which point they became a continuous sheet of the brown iris, running parallel to the blue iris. Between these bands of brown iris, near the ciliary body, ridged, circular strands of white tissue were seen. These were interpreted as remnants of lens capsule. The fundus of this eye appeared normal for an aphakic eye.

Discussion

Loewenstein and Foster made a pathologic examination of an enucleated eye in their case. They felt that the changes were due to a physiologic aging process of the iris in which the middle layers became atrophic and split.

The only case of detachment of the anterior layers of the iris, attributed to trauma, was by Schoenberg.[3] His patient had separation of a portion of the iris, following a high dive. In all the cases reported, however, only a fragmented detachment of a relatively small portion of the iris was mentioned.

With the history of injury and the presence of aphakia in an eye which had not had intraocular surgery, trauma would seem the only logical explanation of the cause of the detachment. The cleavage occurred between the two primitive ectodermal layers of the iris, the potential cavity of the primary optic vesicle. The anterior layer, which must have contained the sphincter and dilatator muscles, could apparently dilate and contract normally. Incidentally, in detachment of the retina, the cleavage is between the same

primitive layers—that is, the pigment epithelium and the inner neural layers.

Summary

A case report of complete traumatic detachment of the iris into two layers has been presented. No case of complete separation of the iris into an anterior and a posterior layer was found in literature.

Scott & White Clinic.

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SENSITIVITY TO PONTOCAINE INSTILLED LOCALLY*

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Pontocaine hydrochloride is a white odorless crystalline powder, very soluble in water, physiologic saline solution, and alcohol. The aqueous solution is stable and can be sterilized by brief boiling. The anesthetic power of pontocaine is 15 times that of cocaine and is superior to procaine as surface anesthesia. It does not cause mydriasis nor is it a cycloplegic. It has no effect on the intraocular pressure. It is not used for infiltration because of its toxicity and is of particular value in the eye, ear, nose, and throat work and for spinal anesthesia. The ordinary strength used is ½ percent for the eye, 1 or 2 percent with equal parts of ephedrine in nose and throat work, and for spinal a 1-percent solution, using 1 or 2 cc.

Case report

Mr. A. came to The Clinic for the surgical removal of a chalazion on his left upper lid. The eye was prepared in the usual way by washing around the margins with green soap and water followed by sponging off with clear warm water. Pontocaine (½ percent) was instilled in the conjunctival sac, 2 or 3 drops being used at 5-minute intervals for three doses. The upper lid was injected with 1-percent novocain, a block being placed around the chalazion area. The chalazion was removed externally in this case by the routine method. No suture was necessary. Following the surgery, penicillin ointment (1,000 units per gm.) was applied to the conjunctival sac, the eye was patched, and the patient discharged.

The following day he telephoned and stated that he had removed the patch, as he had been instructed to do, and had noticed that there was some swelling of the upper eyelid. He was advised that this was not uncommon following such surgery but that it usually disappeared in a few days.

At the next visit, which was the second postoperative day, it was noted that there was an intense local reaction, characterized by a fiery redness of the upper and lower lids on the left side, some conjunctival injection, and a peculiar erysipeloid streaking along the temple following down the back of the ear, in the exact direction that the temple part of his eyeglasses followed. There was intense itching in the area.

This was assumed to be a case of penicillin sensitivity as a considerable number of such reactions had been seen after its local use. Benadryl, 50 mg., 3 times daily, was given and all topical medications were stopped. The patient, however, insisted that

* From the Department of Ophthalmology, The Clinic.

he had used penicillin ointment at home two or three times since he had reported the swelling but that he had not noticed any increase in the symptoms or in the objective findings.

When he was taken to the Medical Department for a demonstration of sensitivity to local penicillin application, the question was raised as to whether sensitization to novocain or pontocaine might not be responsible for the reaction.

Patch tests were made on the flexor surface of the arm for ½-percent pontocaine and ophthalmic penicillin ointment, and an injection of novocain was used in order to determine which was the offending agent.

The following day the patient came back with a marked vesicular eruption in the area where the pontocaine had been used but no reaction at all in the region where the novocain or penicillin had been applied to the arm. There were redness and itching extending over the limits of the pontocaine patched area and at the same time there was an increase in the objective findings around the eye along the temporal margin and even down the back of the ear.

Local therapy, in the form of moist warm packs, was given for the temporal and ear regions and the patient was assured that the process would gradually subside. He was not seen for 4 or 5 days following this visit and, when he came in, the eruption on his arm and eye had entirely disappeared and there were only a few remaining scales on the back of the ear. The patient volunteered the information, however, that about two days following the previous visit his arm had become red and swollen clear up above the elbow, that it was almost impossible to touch it, and that the itching was severe. To the best of the patient's knowledge this was the first time ½-percent pontocaine had been instilled in his eye.

Since no report of a similar case could be found in the available literature, we wrote to Dr. Marion Sulzberger* of the New York Post-Graduate Hospital, New York Skin and Cancer Unit, to inquire if he had any knowledge of such cases or if he could refer us to reports in the literature. His reply was that he had seen some cases of allergic dermatitis due to pontocaine and referred us to an article by Rothman, Orland, and Flesh.†

The article dealt with an eczematoid allergic reaction from procaine in a young dentist who, when subsequently skin tested, was found to be sensitive to the following members of the procaine group: procaine, butyn, larocaine, pontocaine, monocaine, and tetracaine, all members of p-aminobenzoic acid esters, containing a secondary or tertiary amine in the side chain. The article give references to other known cases of hypersensitivity to procaine.

Because pontocaine is used so universally in an ophthalmic practice it does not seem logical that there have been no similar reactions encountered. At least, no one has thought it important enough to report such a manifestation. Looking at it from the patient's point of view, however, it is important for the physician to be aware of such a possibility for guidance in future medication. Just what might happen to an individual with such a sensitivity if he were to be given a spinal anesthetic of pontocaine is hard to visualize. It might have serious consequences.

Summary

A case of sensitivity to ½-percent pontocaine, demonstrated by patch test, following instillation in the eye previous to surgery has been presented. Had it not been for the skepticism of the Medical Department, penicillin might have been unjustly accused of causing another local reaction following its topical application to the eye.

South Hotel Street at Thomas Square (53).

* Personal communication.

† Journal of Investigative Dermatology, **6**: 191, 1945.

LUPUS ERYTHEMATOSUS

A Case Report

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The ocular findings in lupus erythematosus have been reported previously, and most recently by Cordes and Aiken[1] who have gone into the general manifestations, etiology, diagnosis, course, and therapy, and in addition have given a detailed report of the clinical and pathologic findings in one case of the acute disseminated type. Microscopic examination of the eye showed widespread vascular occlusion with subintimal thickening of the arterial and arteriolar walls, hemorrhage, and exudation. They feel that a "toxic retinitis" manifest by a dilatation of the retinal vessels, edema, and possibly hemorrhages is probably the most typical fundus picture seen in this disease. They concluded, after considerable review of the literature and a detailed study of their own case, that there was no single ocular lesion or combination of lesions pathognomonic of lupus erythematosus.

Maumenee[2] reported case histories and autopsy findings of four cases of chronic lupus erythematosus. They demonstrated small superficial retinal hemorrhages, slight papilledma in three, and superficial exudation manifest by fluffy white areas in three. Sections showed round-cell infiltration of the choroid, choroidal and retinal exudation and hemorrhages, and cytoid bodies. The cytoid bodies were not considered pathognomonic, but merely the manifestation of a severe generalized reaction that accompanied the disease.

Koch and McGuire[3] reported a case demonstrating superficial retinal hemorrhages and exudation. There were no autopsy findings. They stressed the importance of early and thorough fundus examination in all cases of "fever of unexplained origin"—a synonym for acute disseminated lupus erythematosus.

Case report

History. The following case report is that of a 37-year-old woman, I. M., whose case had been diagnosed as one of chronic discoid lupus erythematosus in 1934. She had received therapy consisting of bismuth, gold, and liver preparations with variable results.

Since 1934, she had experienced repeated attacks of joint pain, malaise, and low-grade fever with a macular scaly rash of the face, arms, and chest. Accompanying this there was a leukopenia and an anemia with occasional albuminuria and hematuria. She had been in the hospital 14 times from March 15, 1946, to October 18, 1946, for blood transfusions.

On October 18, 1946, she was readmitted to the Queen's Hospital, acutely ill, complaining of pain in the left shoulder, severe generalized headache of four days' duration, stiffness of the neck, and occasional vomiting of bloodtinged sputum.

Physical examination revealed the skin lesions of lupus erythematosus, a generalized purpura, and slight enlargement of the spleen. There was slight cervical rigidity. Blood pressure was 88/54 mm. Hg.

Laboratory reports. Rbc., 2,040,000; Hbg., 64 percent; Wbc., 7,240; Polys., 55 percent; Lymphs., 42 percent; Monos., 2 percent; Platelets, 36,000. Urine was negative upon admission but subsequently showed a persistent 1+ to 2+ albumin and occasional microscopic hematuria. The platelets dropped to 9,720 and the red cells dropped to 1,830,000 with 46-percent Hbg.

Eye condition. On October 31, 1946, the patient complained of a rather sudden loss of vision in both eyes. Examination revealed light perception only bilaterally, semidilated pupils which reacted very slightly to light, and no fundus reflex. It was assumed that she had had either a massive intravitreal hemorrhage or a subhyaloid hemorrhage.

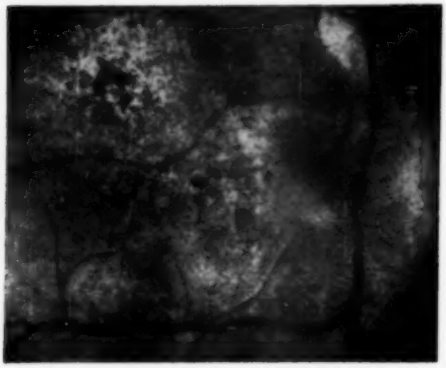

Fig. 1 (Pinkerton and Pinkerton). Right eye, showing extensive granular atrophy and fibrosis throughout the macular area.

On November 12, 1946, a splenectomy was performed. There was an immediate improvement in her general condition, the platelet count rising to 60,000 and falling off to 22,000 at the time of discharge, and a clearing of the purpuric lesions. The patient was discharged on December 9, 1946.

Course. Improvement of the eyes, however, was considerably slower. On December 20th, there was still no fundus detail present, there being only a mat of gray debris best seen with a +12 lens. On February 5, 1947, there was a faint pink fundus reflex centrally. Inferiorly there was a grayish reflex due to a proliferating retinosis. Vision at that time was: R.E., hand movements at 5 feet; L.E., counting fingers at 4 feet.

There was progressive clearing of the media and on April 24th, the vision was correctible to: L.E., 20/200; R.E., counting fingers at 4 feet. She was later fitted with telescopic spectacles, obtaining no improvement in the right eye and a vision of 20/50−1 and J12/17 in the left, thus enabling her to read slowly and carry out her business affairs.

Throughout the retina of both eyes there was a diffuse depigmentation and granular atrophy, best seen in the macular areas. There was no ophthalmoscopic evidence of arteriosclerosis, although judging from the degree of retinal damage and case reports of the microscopic findings in this disease it is probable that such could be demonstrated microscopically.

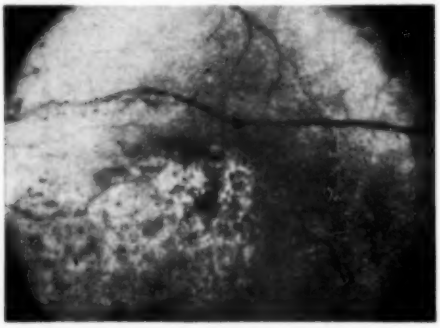

Fig. 2 (Pinkerton and Pinkerton). Left eye, showing less marked atrophy and fibrosis throughout the lower macular area.

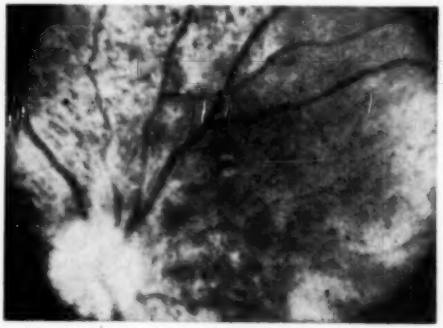

Fig. 3 (Pinkerton and Pinkerton). Left eye, showing parapapillary fibrosis, depigmentation, and pigment clumping.

Figure 1 shows the macular region and immediate surrounding retina of the right eye in which the final vision was only counting fingers at 4 feet. The nervehead was not atrophic. Figure 2 shows the macular region of the left eye in which the final vison was 20/200 correctible to 20/50−1 with telescopic spectacles. Figure 3 is included only to show the extreme degree of involvement of other parts of the fundus and demonstrates more clearly the fibrosis, depigmentation, and pigment clumping.

The sudden onset of visual loss was most likely a purpuric hemorrhage but retinal lesions were probably present prior to the gross visual loss. The change from a chronic, discoid lupus to the acute fulminating, disseminated type is not unusual. Survival is unusual and, in this case, was due to the splenectomy which halted the extensive fulminating purpuric process.

7 Young Building (9).

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PUPILLOMETER AND KERATOMETER CARDS

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These simple pieces of equipment* were devised for quick measurement of the size of the cornea and pupil. The cards illustrated in the two figures are made of white plastic and measure 4 by 10 cm. (fig. 1) and 3 by 15 cm. (fig. 2).

By holding the appropriate card at the temporal side of the orbit in close approximation to the eye one can estimate within a quarter of a millimeter the size of the pupil or cornea. In adults it is sometimes desirable to know the size of the cornea. In congenital glaucoma it is of considerable importance.

The discs may be colored with crayons to match the common color of the iris; this makes measurement even easier and more accurate.

The pupillometer is useful not only to doctors and assistants in the office, but also to nurses at the hospital for measuring the effect of myotics and mydriatics. Thus the surgeon is enabled to receive accurate information by telephone concerning the size of the pupil, preoperatively or postoperatively, in a case of adult or infant glaucoma.

490 Post Street (2).

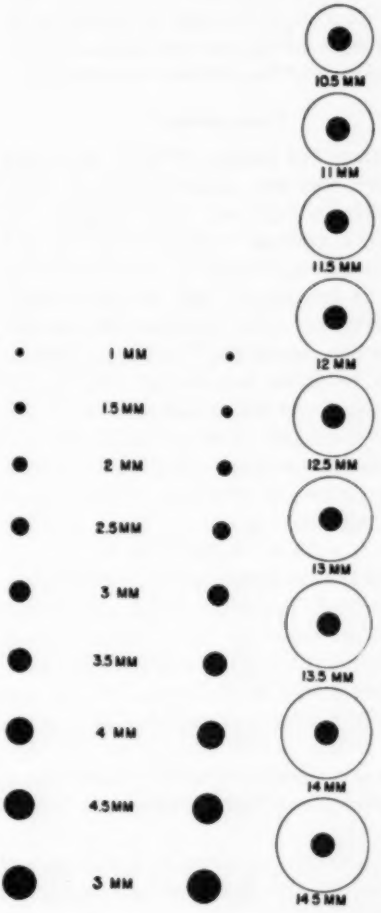

Fig. 1 Fig. 2

Figs. 1 and 2 (Otto Barkan). (Fig. 1) A pupillometer card. (Fig. 2) A keratometer card.

* Pupillometer and keratometer cards are supplied by A. H. Parsons Laboratory, 442 Post Street, San Francisco.

A CASE OF SELF-MUTILATION INVOLVING BOTH EYES*

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Randolph Field, Texas
AND
JULIUS M. SHIER, M.D.
Saint Louis, Missouri

This case is reported as a matter of interest; the patient having made four attempts to remove his eyes using the handle of a common teaspoon. No similar case was discovered in a review of the literature and in none of the reported cases of self-mutilation were the attempts so persistent.

CASE REPORT

History. The patient, F. W., a man, aged 52 years, was first seen at 3:20 P.M., May 25, 1947, at St. Louis City Hospital. He presented with the statement that he had become "nervous" and for that reason had made an attempt to "dig out his eyeballs with a spoon." The attendant, who accompanied him, stated that the patient had inserted the spoon behind the right eyeball from above and that he had achieved a considerable amount of proptosis by the time he was discovered and was forced to desist.

The patient, by this time, was complaining of pain and expressed a desire to retain as much sight as could be saved.

Examination of the right eye showed subconjunctival hemorrhages and conjunctival lacerations especially in the upper fornix. Ophthalmoscopic examination revealed peripapillary retinal hemorrhages. The examination of the left eye showed that he had also made a less severe attempt on this eye. There was a small conjunctival laceration in the upper fornix but no intraocular hemorrhage.

The patient was given local therapy and admitted to the Eye Service. Psychiatric consultation revealed the presence of psychosis, type undetermined, possibly an involutional melancholia. He was then transferred to the Psychiatric Service.

Second attempt. The patient was apparently doing well, when suddenly and without warning, he attempted to remove his left eye, again using a spoon handle. This time with such force that the globe was ruptured. There was a tear 6-mm. long extending through the conjunctiva, sclera, choroid, and retina and extending in a curved line from approximately the 12-o'clock position near the limbus to the 9-o'clock position. Examination revealed that the lens, iris, and a large portion of the vitreous had been extruded. The eyeball was collapsed and there was considerable hemorrhage within the globe so that fundus details could not be seen.

The patient was again contrite and wished to have every effort made to save his sight. He was taken to the operating room and the wound closed by the use of intrascleral sutures of 6-0 black silk.

Following this episode, the patient was placed in restraints. Further psychiatric therapy included electric-shock treatments.

Course. The patient's postoperative course was uneventful until the evening of June 6, 1947, at which time an attendant, against doctor's orders, unlocked the restraints and gave the patient a spoon with which to eat his dinner. Following the meal, the patient promptly reversed the spoon and, by using considerable pressure into the orbit, he was able to tear the conjunctiva and Tenon's capsule completely from the limbus.

These tissues were torn loose as closely as they can be incised surgically. The spoon had been inserted directly behind the eyeball forcing it forward so that the eyelids were closed behind it. When seen the patient presented a rather startling appearance with his eyeball entirely exposed in front of his lids (fig. 1).

* From the Air University School of Aviation Medicine.

Outcome. The patient was again taken to the operating room where Tenon's capsule was carefully irrigated with a 1/5,000 solution of aqueous zephiran, followed by penicillin (500 units per cc.). Check was made with a strabismus hook and all extraocular muscles were found to be undamaged. The conjunctiva and Tenon's capsule were pulled back in position and sutured in place at the limbus using 6-0 black silk.

Ophthalmoscopic examination showed an apparent partial avulsion of the optic nerve with numerous hemorrhages surrounding the disc. Visual acuity at that time was reduced to hand motion. The patient made an uneventful recovery, receiving 30,000 units of penicillin intramuscularly every three hours. Examination on June 18, 1947, revealed a visual acuity: O.D., 20/200; O.S., hand motion at one foot. On August 17, 1947, visual acuity was O.D., 20/20; O.S. unchanged.

There was one additional attempt made by this patient to injure his right eye with his finger nails, but he had insufficient time and his restraint was too well placed to allow him to cause any real damage.

Comment. The Psychiatric Service in evaluating this patient believe that he was motivated by a guilt complex. He had led a life in which crime played a large part and had served several sentences for robbery. He had also evaded deserved jail sentences on several occasions. As his eyes were the agents by which he saw things he could steal, he apparently felt they were tempting him to continue his life of crime.

Possibly the Biblical admonition, "If thine eye offend thee, pluck it out," was a part of the motivating influence. Although this could never be definitely established, it was believed by the Psychiatric Service to be the mechanism which prompted him in these attempts at self-mutilation. He improved under electric-shock therapy and it may be that he will not again attempt to put out his eyes.

Fig. 1 (Byrnes and Shier). Appearance of patient after he had used a spoon in an attempt to enucleate his right eye. Tenon's capsule and the conjunctiva were torn loose at the limbus and the eyeball was pulled forward in front of the lids.

SUMMARY

A case has been reported in which an individual made attempts on four occasions to remove his eyes with the handle of a teaspoon. Two attempts were made on the left eye resulting in a collapsed globe with final visual acuity of hand motion only. Three attempts were made on the right eye with complete limbal dissection of conjunctiva and Tenon's capsule and dislocation of the eyeball anterior to the lids on one occasion. The final visual acuity was 20/20. These attempts were apparently motivated by a guilt complex in a case of involutional melancholia.

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ANGIOID STREAKS OF THE RETINA*

RETINITIS MELANORETICULATA

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In studying the evolution and nature of angioid streaks of the retina, it has been my observation that they appear not only as streaks, but that they may form a true

* Read before the Bulgarian Society for Ophthalmology, December, 1946.

net behind the retinal vessels (retinitis melanoreticulata). Further, it has been observed that this pigmented net can disappear altogether, leaving the fundus clear. To support these observations, the following case is presented.

Case report

History. The patient, a woman, aged 32 years, had been under observation for seven years at the time of writing. She first presented herself in 1940, complaining that she could not see well with her right eye. Ophthalmoscopic examination at this time (1940) showed fully developed angioid streaks in both eyes.

Eye examination. In the left eye, the streaks originated in an incomplete, pigmented circle around the papilla and radiated toward the periphery of the fundus with the formation of many anastomoses. Thus, a true pigmented net was created.

Around the papilla, this pigmented net was denser, thicker, and more pronounced. The pigmented streaks and net were lying behind the retinal vessels which, although they were of different caliber and lacked the reflex and border of true vessels, appeared as vessels.

Vision in the left eye was 6/20 with a −3.0D. sph. ⌒ −3.0D. cyl. ax. 180°. Perimetric studies and adaptation were satisfactory.

The right eye presented the same pigmented net, but it was less dense, especially temporally. Some of the streaks appeared flat, and a feeble red reflex was seen here and there through them. A red hemorrhagic spot, seen in the region of the macula, was the cause of the diminished central vision.

Vision in the right eye was 6/50 with a −3.0D. cyl. ax. 180°. Field studies showed a central scotoma.

Physical examination. General physical examination showed the patient to be suffering from hypercholesteremia and tracheobronchial adenopathy.

Course of eye condition. By 1941, both the hemorrhage in the macula of the right eye and the central scotoma were larger. The condition had also progressed in the left eye.

In 1942, examination showed the hemorrhage in the macula of the right eye to be further diminished, but the pigmented streaks and net remained the same.

By 1943, the hemorrhage in the macula of the right eye had disappeared. Vision in the right eye had improved to 6/20, with correction; that in the left eye to 6/15, with correction.

Three years later (1946) the pigmented streaks and the whole pigmented net had disappeared altogether in the temporal portion of the left eye. A few pigmented streaks were still to be seen in the nasal half of the fundus near the papilla. The fundus was clearer and brighter.

With the exception of some pigmented streaks in the nasal half of the fundus, the pigmented net had also disappeared in the right eye. Some brilliant points were seen in the macula, and some insignificant changes were seen in the choroid.

Vision at this time (1946) was: R.E., 6/15, with correction; L.E., 6/10, with correction. Peripheral vision was good, as were color sense and adaptation.

Treatment. Salt injections were administered for the hemorrhages. Vitamins A and C were prescribed internally, together with calcium. A diet free from fats was prescribed.

Conclusions

1. It has been observed that angioid streaks may appear not only as streaks but can form a true net behind the retinal vessels (retinitis melanoreticulata).

2. This pigmented net can disappear and leave the fundus clear, just as do hemorrhages in the macula.

3. That angioid streaks are "indelible" is not true in all cases.

Discussion

The fact that these pigmented streaks and nets may disappear throws a new light on the subject of angioid streaks. The hypothesis that they are remnants of congenital vessels or a proliferation of new vessels into scar tissue (W. T. Lister and Parsons) is no longer sustainable.

The hypothesis of elastic tissue friability as a cause of ruptures of the lamina vitrea also becomes doubtful, since the ruptures of this elastic membrane are "indelible" and since they also show a different ophthalmoscopic picture.

Further biochemic and histologic studies may reveal that these pigmented streaks and nets are the results of metabolic pigment infiltration in the deep layers of the retina, capable of disappearance upon the improvement of the metabolism.

In the case herein presented, the only metabolic disturbance observed was that of hypercholesteremia. There was no evidence of arcus senilis, xanthelasma, and pseudoxanthoma elasticum, and no symptoms of morbus addisonii.

6171 Rakowsky.

STREPTOMYCIN IN RETINAL TUBERCULOSIS

A case report

Peter Sykowski, M.D.
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It was Henry Eales[1] (1880) who first described recurrent hemorrhages into the retina and into the vitreous. Attention was directed to the causative importance of the Koch bacillus by the investigations of Axenfeld and Stock (1911). Histologically, Gilbert[2] (1935) has proved the tuberculous etiology of the condition.

Relative to the "vexed question" of retinal tuberculosis, Duke-Elder[3] states that: "In all cases, however, the habit of the disease, like most tuberculous manifestations, is to recur intermittently, so that no sooner is one hemorrhage tending to clear up after a slow and tedious course than another occurs, a sequence which may be repeated for many years despite the most well-intentioned and thorough treatment. In such cases the process may suddenly cease apparently for no particular reason. . . ."

With the above quotation in mind, streptomycin therapy[4] was instituted in a case of retinal tuberculosis.

Report of case

History. A 32-year-old white man was seen in July, 1947, with the prominent complaint of numerous vitreous opacities and of diminished visual acuity in both eyes, especially the left.

The past ocular history revealed that in July, 1943, the patient had experienced a vitreous hemorrhage in the left eye. At this time, pulmonary skiagrams showed a haziness of the left apex and the tuberculin skin-test reaction was moderately severe. A diagnosis of ocular tuberculosis was made and for a period of nine months tuberculin desensitization was carried out. In 1945, during a two weeks' course of daily intravenous cevitamic acid injections, a vitreous hemorrhage occurred in the right eye.

Ophthalmic examination. The visual acuity without correction was: R.E., 20/40; L.E., 20/60. Corrected vision was: R.E., 20/25; L.E., 20/40. Except for an old corneal opacity in the right eye, biomicroscopy was normal. Ophthalmoscopy showed numerous vitreous opacities in both eyes.

In the right eye, the disc had a slight temporal pallor. The macula was unremarkable. The blood vessels appeared to be normal. At the periphery, in the 9-o'clock meridian adjacent to blood vessels, there were several retinal hemorrhages, the largest being one-half disc diameter in size.

In the left eye, the papilla appeared slightly paler in comparison with the right eye.

In the macula there was increased granulation. At the periphery in the 2-o'clock meridian there were three pigmentary clumps and one small hemorrhage parallel to and adjacent to the blood vessels. Throughout the fundus were scattered several small pigmentary clumps.

Treatment and course. Streptomycin therapy (1.0 gm., daily) was instituted and continued for a period of three months.

At the end of this time, subjectively, the patient felt no improvement. Objectively, without correction, vision in the right eye was 20/25, and in the left eye, 20/30-2. The retinal hemorrhages were absent. In the right eye in the former areas of the retinal hemorrhages at the 9-o'clock meridian, a pigmentary clump was present. Similarly, in the left eye an additional pigmentary clump was present at the 2-o'clock meridian.

Comment

Whether streptomycin is of value in retinal tuberculosis has not been proved. Because of the absence of retinal hemorrhages after the course of treatment, however, one can assume that streptomycin was responsible for some improvement; at least, it apparently prevented further hemorrhages—retinal as well as vitreous.

Summary

Streptomycin may be assumed to be of value in the treatment of retinal tuberculosis.

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Ophthalmic miniature

In our own species, individuals with light choroids see in weak light better than those in whom the membrane is dark. The light of day is too powerful for the Albino; it dazzles him, and obscures his vision. . . . The ferret, which has not pigment, is a kind of subterraneous animal, following its prey under ground; and the rabbit, in which the same deficiency so often occurs, requires, from its habits of life, a similar kind of vision.

Sir William Lawrence, *A Treatise on the Diseases of the Eye*, 1833.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 2, 1948

DR. DANIEL KRAVITZ, *president*

A NEW APPROACH TO THE THEORY OF RETINOSCOPY

DR. JOSEPH PASCAL discussed this subject during the instruction period.

PRACTICAL APPLICATIONS OF THE DENERVATED IRIS:

DR. NORMAN S. JAFFE said that much of the controversy over the psychosensory pupillary dilation reflex is due to the failure to recognize that this reaction is complex and involves two separate and distinct mechanisms.

The first phase is purely nervous and involves stimulation of the cerebral cortex with subsequent peripheral sympathetic stimulation and coincidental 3rd-nerve inhibition. It is a rapid reaction and has a latency period of between 0.292 and 0.46 seconds according to different observers. It subsides rapidly, does not involve medullary secretion of adrenalin, and occurs with both weak and strong psychologic or sensory stimuli. This may be called the "true psychosensory dilation."

The second phase is purely hormonal. It is a delayed reaction and does not occur until 6 to 8 seconds following the stimulus. It subsides gradually, involves stimulation of the center in the floor of the fourth ventricle or in the hypothalamus with the subsequent release of adrenalin by the adrenal medulla, and occurs only in response to strong psychologic or sensory stimuli. This may be termed the "delayed psychosensory dilation of the pupil."

Dr. Jaffe said that the above conclusions were reached as the result of a series of three experiments:

1. Cats previously subjected to right cervical pre- and postganglionic sympathectomies were used. The experiment was performed 2 to 3 months after the nerve sections. Motion pictures (using pupillographic technique of Lowenstein) were taken of the reactions of both pupils as a gun was sounded. The normal pupil dilated immediately. The sympathectomized pupil also dilated immediately, but only to one-fifth of the magnitude of the normal reaction. This demonstrates the role of the sympathetic in psychosensory dilation.

2. In this experiment to insure the outpouring of adrenalin from the adrenals, a strong stimulus was used. A gauze moistened with ether was placed near the postganglionic sympathectomized cat's nose and pictures were taken again. The normal left pupil dilated immediately. The denervated pupil showed only a weak dilation (one fifth normal) until 6 to 8 seconds of excitement ensued. It then dilated to such an extent that it far outdistanced the normal pupil. This is a manifestation of the law of denervation and demonstrates the hormonal factor.

3. In this experiment the hormonal factor was eliminated by removing the adrenal glands in an animal which had previously been subjected to a postganglionic cervical sympathectomy. The ether gauze was again placed near the cat's nose and pictures were taken. The normal pupil dilated immediately. The denervated pupil dilated minimally (one fifth) but after 6 to 8 seconds dilated slightly again. The total dilation was about two fifths of that observed on the normal side. The second slight dilation was probably due to hepatic liberation of adrenalin with its

subsequent action on the denervated iris.

Discussion. Dr. Otto Lowenstein said that Dr. Jaffe made two important statements: (1) The psychosensory dilation of the pupil consists of an immediate and primary, and a delayed secondary stage; (2) the secondary stage is due to a hormonal mechanism, by which adrenalin is liberated from the adrenal glands. The primary reaction comes into play as answer to every psychosensory stimulus, whether strong or weak; the secondary only as reaction to strong emotions or sympathomimetic drugs, such as ether and probably aminopyrine; in other words, such drugs which exert a direct influence on the central autonomic centers.

Up to now phenomena similar to those described by Dr. Jaffe, were shown only in experiments with the heart as an indicator. However, since those strong stimuli put central mechanisms into motion, we are dealing with sympathetic phenomena of central origin. Central sympathetic phenomena never appear in one organ only, but always irradiate everywhere all over the body; therefore, it is logical to expect them to show up in the pupils as well. The fact that they really do is of great theoretical and practical interest, since every symptom which we discover in the pupils may possibly open another window through which we are able to look at the functions of the autonomous centers. Dr. Lowenstein said that he would limit his discussion to those anisocorias which are due to disturbances of the dilation mechanism of the pupil.

Anisocoria is known to be a very frequent condition. The frequency of its occurrence in so-called normal individuals without clinical neurologic or local ocular abnormalties is indicated by different observers as between 21 and 40 percent. Frequently anisocoria may be an insignificant symptom; but frequently it is very significant. Therefore, every instance of anisocoria should be made the object of thorough examination, and every effort should be made to detect its nature, its localization, and its etiology, before we are allowed to say that the condition with which we are dealing is harmless.

When we see a case of anisocoria we have, first, the problem of finding out whether the larger or the smaller pupil shows a pathologic condition, and whether the symptom is due to a weakness of the dilation or the contraction mechanisms.

Dilation mechanisms come into play not only with the psychosensory dilation reflex, about which Dr. Jaffe spoke, but also with the reflex to light, when the contracted pupil redilates; or with the reflexes to near vision, to lid closure, or darkness.

It is generally assumed that dilation mechanisms are either due to the innervation of the sympathetic or to the relaxation of the parasympathetic, while contraction mechanisms are considered to be exclusively due to the innervation of the parasympathetic. This is not completely true inasmuch as the second and third part of the contraction, for instance of the reflex to light, is due to a considerable degree to sympathetic influences, while the secondary and tertiary parts of the redilation are to a considerable part due to parasympathetic influences. This means that the anisocoria of a lesser degree which appears in the redilation phase may be due to a parasympathetic disturbance; otherwise any anisocoria of considerable amount which is due to disturbances in the dilation mechanism is mainly sympathetic in origin.

Up to now we thought that any sympathetic anisocoria of high amount, in which both pupils were dilated although to a different degree, must be central in origin; especially when the size of the pupil changed very much at different times. We observe that type of anisocoria in cases of Adie's syndrome, of postencephalitis, and of tumors in the neighborhood of the third ventricle.

Dr. Jaffe's observations and experiments suggest the possibility that cases exist in which, after recent severance of the peripheral sympathetic, either post- or preganglionic, anisocorias may develop of the following type: one pupil is very much dilated,

the other pupil dilated. This condition would exist as long as the patient is under strong emotion; for instance, in a condition of anxiety, of fear, or fright.

This anisocoria would be transitory inasmuch as it should disappear when the emotion disappears. Such a dilated pupil may or may not be able to react to light but, in cases where it does not react to light, it must be expected that it does not react to near vision either. This condition, however, could exist only as long as no regeneration, not even any part, of the severed pre- or postganglionic nerve has taken place. The condition is expected to be more pronounced in cases of postganglionic than of preganglionic severance.

Retinitis albescens with macular involvement

Dr. Howard Agatston said that he reported the following case because: (1) Peripheral involvement is rare, particularly in the early stages of the disease; (2) the function of the peripheral retina in this case was studied by a new technique.

A healthy appearing, intelligent 11-year-old girl of Italian parentage complained of gradually decreasing central vision for the past three years. Her parents were first cousins. The only other sibling, a 9-year-old boy, had normal eyes. There was no history of night blindness and no signs of cerebral degeneration. General history and examination were negative. Positive ocular findings were as follows:

1. Emmetropia. Vision: O.D., 10/200; O.S., 20/200.
2. Poor light adaptation.
3. Macular degeneration and early degeneration of the paracentral and peripheral retina. The ophthalmoscopic appearance resembled textbook pictures of retinitis punctate albescens or disseminated colloid degeneration.
4. Normal visual fields except for a 2-degree, relative central scotoma.
5. The rate of dark adaptation was one half the normal speed. After bleaching of the retina, the visual fields in standard dim illumination took 20 to 22 minutes to return instead of the usual 10 minutes.

These findings point to both a progressive heredomacular degeneration and a peripheral tapetoretinal degeneration. Perhaps in the future, this peripheral lesion will develop into a distinct form of retinitis pigmentosa or into the juvenile type of amaurotic family idiocy (the disease described by Vogt and Spielmeyer or by Batten and Mayou). Naturally the discovery of some form of hereditary retinal degeneration in other members of the same family would throw additional light on this case.

Discussion. Dr. Joseph Mandelbaum said that the dark-adaptation test performed on this patient with the Hecht-Schlaer apparatus indicated a moderate reduction in light sensitivity, particularly in the central and paracentral regions, where the elevation in light threshold was approximately one log unit. Further peripherally, the elevation was only slight. The speed of the dark-adaptation curve was normal, the break between cone and rod function occurring at about seven minutes.

According to Dr. Agatston's method, the recovery of sensitivity seemed delayed. This apparent contradiction between our results is due to the fact that he used a stimulus of fixed intensity near the cone threshold. With diminished retinal function, this stimulus can be seen only by rod cells and its perception is therefore delayed until rod adaptation is well under way.

Repair of a perforating wound of the cornea

Dr. Daniel M. Rolett presented two cases of perforating corneal wounds which he repaired by direct suturing of the cornea.

Case 1. A 4-year-old girl was injured by a knife and had a perforating wound of the cornea between the 12- and 6-o'clock positions from limbus to limbus. There was

prolapse of the iris and the lens capsule was split. The cornea was repaired with several 6-0 silk sutures and a capsulotomy was performed. Two months following the injury, the vision was fingers at six feet.

Case 2. A boy, aged six years, had a corneal wound from the 11- to the 5-o'clock positions, with a swollen lens. The treatment was the same as in the first case and three months after the injury only a few cortical masses remained and the vision was fingers at five feet.

Dr. Rolett concluded that this type of injury is best treated without conjunctival flaps, and he showed motion pictures of the procedures used.

Discussion. Dr. Daniel Kravitz said that Dr. Rolett's method of repairing perforating wounds of the cornea is used regularly at the Brooklyn Eye and Ear Hospital. He said that the conjunctival flap is not used at all and that he himself had been using sutures for many years. He asked Dr. Rolett how his method differs from the usual method employed.

Dr. Rolett replied to Dr. Kravitz that a number of cases of this type are still being treated by conjunctival flap. He said that, in severe perforating injuries where the eye is collapsed, an attempt should be made to save the eye by first repairing the wound with corneal sutures.

Congenital retinal folds

Dr. Benjamin Esterman presented four cases of congenital retinal folds, three bilateral and the fourth unilateral with abnormality of the retina of the opposite eye. All four had nystagmus and poor vision. The patients were poorly developed physically and mentally. Two were nonidentical twins.

The folds were typical in that each ran from the disc inferiorly and temporally to attach to the equator of the lens, at which point there was an opacity; the points of reflection of the retina onto the fold were marked by heavy pigmentation of the fundus; each fold was characterized by a vessel or vessels originating from the disc and running longitudinally along most of its length, while other vessels on the retina were scarce or completely absent; and the remainder of each retina was disorganized.

Discussion. Dr. Frederick H. Theodore said that retinal folds are often confused with retinitis proliferans particularly when only one eye is involved. He mentioned that many cases can be seen in institutions for the blind and that he had come across many others in the Army. Dr. Theodore then showed slides of retinal folds.

Follicular conjunctivitis caused by streptothrix

Dr. Frederick H. Theodore presented a case of unilateral follicular conjunctivitis due to streptothrix concretions in both the upper and lower canaliculi. The involvement of the canaliculi was minimal; externally they appeared quite normal. Within two weeks after removal of the concretions, the follicles, which had involved the upper and lower lids and fornices, disappeared completely. The diagnosis was faciliated by the routine procedures of making epithelial scrapings and secretion smears. Examination revealed the characteristic findings occurring in streptothrix infections.

Conjunctivitis due to streptothrix (actually a mild actinomycosis) is by no means rare. Follicular conjunctivitis due to this organism, however, is quite unusual. Only four such cases are recorded in the literature, all occurring in Europe.

Clinically three types of streptothrix infections may be differentiated. The first type, involving the bulbar conjunctiva, apparently does not occur in this country. The second group, those with obvious involvement of the canaliculi, are often mistaken for other conditions. The third type, those cases in which only conjunctival signs are present and the canaliculi appear normal, can only be diagnosed early if epithelial

smears and scrapings are done. The case reported above falls into this third group and may be explained as a toxic response occurring in certain susceptible individuals, as most cases of streptothrix infection do not show this reaction.

Discussion. Dr. Milton Berliner asked Dr. Theodore whether he was sure that he was dealing with follicles in the case he reported. He said that sometimes they are confused with papillary hypertrophy. In bacterial infections and in allergy, papillae are the rule rather than follicles. In virus infections, as is to be expected, lymphoid reaction causes a predominance of follicles.

Dr. Frederick Theodore replied to Dr. Berliner that he felt there were follicles in the case reported for the following three reasons:

1. Follicles involve the fornices, while papillae involve only the tarsal conjunctiva.
2. Although papillae may be quite large, as in vernal catarrh, follicles are generally larger.
3. Follicles are palish gray, or yellowish-white, as were these in the case reported, while papillae have a core of blood vessels.

In this case, therefore, they were true follicles since they involve the fornices.

Postoperative epithelization of anterior chamber

Dr. Edward Saskin said that epithelial invasion, which was first described by Collins in 1892, is the term applied to the extension into the eyeball of epiglobal epithelium, following penetrating wounds whether operative or not. When healing is complete, there is usually a prolonged period of quiet during which the eye is free from subjective or objective signs of irritation. This period may last from months to years. The onset of irritation due to epithelial invasion is usually marked first by subjective symptoms as blepharospasm, photophobia, lacrimation, and pain. These symptoms usually antedate any recognizable signs of epithelization. The next phase of this condition is manifested by evident epithelial cysts in the anterior chamber and an increase in subjective symptoms, passing over into the ultimate and terminal phase of hypertonia.

Treatment is to a large extent prophylactic. As nearly perfect as possible coaptation of wound edges is the prime requisite. This was proved true by Corrado, in 1931, when he demonstrated that the mere presence of a strip of epithelium in a wound will not cause proliferation, but must be associated with a delayed wound closure. Prophylaxis should, therefore, also include debridement and prevention of uveal inclusions.

Therapeutic measures, such as chemical cautery and radiation, are usually of no help, enucleation ultimately being required.

Dr. Saskin reported the case of a 71-year-old, white woman, who had a completely uneventful intracapsular cataract extraction with a quiet convalescence. After six weeks, lenses were ordered with a corrected vision of 20/30. Two months after surgery she complained of lacrimation, photophobia, and mild pain, which persisted in spite of a completely negative eye examination. About one month after the onset of these complaints, epithelization of the anterior chamber was noted. X-ray treatments were of no avail. Uncontrolled, hypertonia supervened, and enucleation was performed seven months after the cataract extraction.

Discussion. Dr. Milton Berliner said that lately he had been interested in making a survey of this complaint at the New York Eye and Ear Infirmary. In this study it was found that in practically all the cases no prepared conjunctival flap had been made, the wound having been closed by either a modified Stallard stitch, or by end to end corneal scleral stitches, the latter placed after the incision was made.

Evidently in such types of suturing, there is always the danger of including conjunc-

tiva in the wound. The exact mechanism of epithelial downgrowth after cataract operation or after injury is still not completely understood. The question as to whether the delayed reformation of the anterior chamber and hypertonia (stressed by Corrado) acts as a stimulus to epithelization is not entirely convincing.

Dr. Berliner said that in two cases he had followed, the wounds closed promptly and the anterior chambers reformed in four days. The argument favoring hypertonia was based on the fact that, with a highly albuminoid aqueous, better nutrition for the promotion of epithelial downgrowth was afforded.

Experimentally, it has not been possible to simulate this condition by the simple implantation of epithelium into the anterior chamber. It has been suggested that endothelial injury at the time of operation may promote a "take" of the epithelium on the posterior surface of the cornea. However, it would seem more likely that growth of the epithelium destroys the endothelium.

In diagnosing this complication, as pointed out by Dr. Vail, it is necessary, first, to have this possibility in mind. Only about 70 cases have been reported in the literature. This probably represents a small fraction of the actual number of cases. Often epithelial downgrowth can be recognized in cases that are incorrectly diagnosed as iridocyclitis and/or glaucoma.

Epithelial downgrowth should be suspected in an eye in which photophobia, pain, and congestion persist after the 3rd or 4th postoperative week. Even during the early stages, it is possible to make the diagnosis by means of the biomicroscope. One will see the opacification on the posterior surface of the cornea in the neighborhood of the wound, and also the presence of blood vessels traversing the stromal thickness. These findings may also be verified by means of gonioscopy.

Dr. Saskin was very pessimistic about therapy. However, Dr. Berliner said that he had had two cases which were arrested and the eyes saved through the efforts of Dr. Albert Kean, radiologist. He recommended the administration of doses varying from 50r. to 150r., 3 to 4 times weekly, until 1,500r to 2,000r. is reached.

BERNARD KRONENBERG,
Recording Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

February 19, 1948

DR. PERCE DELONG, *chairman*

LAWRENCE-MOON-BIEDL SYNDROME

Dr. O. A. CAPRIOTTI (by invitation) gave a brief review of the literature, followed by the presentation of a case.

CASE REPORT. This patient, a young woman, aged 20 years, was admitted to the Wills Hospital in December, 1947, on the service of Dr. Shipman.

Her chief complaint was poor vision. The patient stated that she began to have difficulty with her vision at about the age of 12 years. Since her vision decreased rather rapidly in the next few years, she had to leave school. At the age of 16 years, her vision became so poor that she was unable to see objects and had to learn to feel her way around the house. She had always been obese even in infancy. There had been six fingers on each hand, the extra fingers were removed when she was an infant.

Family History. The patient was the 3rd of 12 siblings. In addition, her mother had had six miscarriages. Two children died during infancy. There were 4 brothers and 5 sisters living. One sister, aged 15 years, the sixth sibling, was blind and obese. Another sister, aged 9 years, the eighth sibling, was blind, obese, and had heart disease. The youngest child, aged one year, was fat. The

paternal grandmother was being treated for a tumor of the right eye.

Physical examination. The patient was 56 inches in height and weighed 135 pounds. She was quite obese with the fat distributed over arms, breasts, abdomen, and thighs. The right breast was about twice the size of the left breast. Hair distribution under the arms and over the mons veneris was normal but rather sparse. Her hands and feet were short and stubby. She had knock knee (genu valgum) and congenital club feet (talipes valgus). There were scars over the ulnar aspect near the distal portion of the metacarpals of both hands where the supranumerary digits had been removed. The patient had a blowing systolic murmur heard over the apex.

Gynecologic examinaton revealed a small labia minora about one-third normal size, a very small clitoris, and an infantile uterus as determined by rectal examination.

Neurologic examination revealed a mental age of 10 years, and an intelligence quotient of 67 as determined by the Hayes-Binet test. The general neurologic examination was essentially negative except for an impairment of motor power.

X-ray findings. The skull was rather small in size, otherwise normal. The sella turcica was normal. X-ray films of the arms and hands showed bowing of both radii, the metacarpals to be small in size, and the second phalanges, short and stubby. X-ray studies of the legs and feet showed a congenital type of club foot (talipes valgus), short and stubby metatarsals and second phalanges.

Laboratory studies. Wassermann and Kahn tests were negative. Basal metabolism rate, plus 2.5. Glucose tolerance test indicated a mild diabetes insipidus. Blood count and urinalysis were normal.

Ocular exmination. Vision: O.U., light perception and projection. Visual fields: O.U., show a marked concentric contraction; the right eye to about 7 degrees and the left to 15 degrees with a 10-mm. target at 33 cm., using the finger for fixation. External examination: O.U., essentially negative except for a horizontal type of nystagmus. Pupils were equal, round, and reacted equally to direct and consensual light.

Ophthalmoscopic examination: O.D.—Lens: fine, posterior polar opacities. Vitreous: fine, granular opacities present. Disc: large, well-defined pigment on the temporal side; waxy in color; deep physiologic cup. The fundus was myopic about 6 diopters. Arteries were narrow, about one-third normal size. A-V ratio was about 2:3. The macula was ill defined and granular in appearance. The retina was thin and the choroidal vessels were easily seen. About two disc diameters away from the disc there were punctate pigment deposits. Going out to the periphery these became linear and more diffuse. They were not particularly perivascular. Some of these may be described as "bone corpuscle" in type. O.S.—essentially as O.D.

Summary. In summary, the case presented demonstrated the classical features of the Lawrence-Moon-Biedel syndrome; namely pigmentary degeneration of the retina, Froelich type of obesity, hypogenital dystrophy, polydactyly, mental retardation, and familial occurrence. In addition, the patient had skeletal defects of genu valgum, talipes valgus, short metacarpals, and short second phalanges of the hands and feet.

Discussion. Dr. James S. Shipman thanked Dr. Capriotti for his excellent presentation of a most interesting case—the type of case of which few of us have seen many. We read about such cases, but it is not often we have the privilege of seeing them. I did not make the diagnosis, and I do not know who made the original diagnosis. One of the residents asked me to see it, and told me the diagnosis before I saw it. However, if one has ever seen one of these cases he should not miss the diagnosis.

Naturally we have all seen many cases of retinitis pigmentosa. Examination of the eyes in this case showed the typical findings

of this condition. In addition, the case showed the other signs and findings which Dr. Capriotti has so well described.

From the literature it would appear that it is rare to find such a classical form and distribution of retinal pigment in this syndrome. According to Clay this occurs in only 15 percent of the cases that have been reported. For this reason I feel that this case fits in as a typical case of retinitis pigmentosa which also shows practically all of the other symptoms, signs, and findings of the Lawrence-Moon-Biedl-Bardet syndrome. I am sorry that the pictures which Dr. Capriotti obtained do not show the true condition of this patient's fundi, because they do have typical retinal pigment on top of the vessels with the characteristic corpusclelike arrangement of bone.

This case also makes us think about the cause of retinitis pigmentosa. We all know that no one has ever given a satisfactory explanation for this condition. There are many theories that have been advanced. Probably the most accepted theory is that of abiotrophy, premature senility, advanced by Collins in 1922, when he talked on this subject in Washington, D.C.

Verhoeff is one of the few men who has made a microscopic section of an eye afflicted with retinitis pigmentosa, and he is inclined to give a good deal of credit to this theory of abiotrophy. He also feels that there is a progressive degeneration of the retinal neuroepithelium with pigment migration. He does not believe that the vascular theory, with sclerosis of the choroid, is too well borne out by microscopic findings.

Other theories that have been advanced are those of hepatic disease with liver dysfunction, as found in some cases by Takahashi, sex-hormone and vitamin-A deficiencies.

Still another theory, which this case points toward, is the glandular theory pointing to some involvement of the pituitary or possibly the ductless glands. Certainly this case shows a definite glandular involvement and makes one think of the possibility of this condition playing some role in the cause of retinitis pigmentosa. I think this case, which is quite typical of retinitis pigmentosa and which has all the other findings suggestive of a glandular disturbance, stimulates us to give some credence to this last theory.

Dr. Francis Heed Adler. Up to a few years ago most authors regarded these cases as typical pigmentary degeneration of the retina with signs and symptoms of pituitary dysfunction, but a few years ago Lyle presented a paper which seemed to me to challenge this conception.

He pointed out that these patients nearly always begin with a central scotoma and loss of central vision, which is certainly not characteristic of pigmentary degeneration, and the case reported this evening bears this out. My feeling now is that we know less about the disease than we thought we did a few years ago.

Dr. I. S. Tassman. About 10 or 12 years ago, I observed three members of one family who suffered with this condition. They were classical cases, and almost identical with the one so well presented here tonight.

In a classical case of Lawrence-Moon-Biedl syndrome, pigmentary degeneration of the retina is nearly always typical in its appearance and is one of the cardinal signs. The other cardinal clinical signs are lowered mentality, obesity of the Froelich type, hypogenitalism, and sometimes polydactylism. The patients are usually short in stature and have spade-shaped hands, often with deformity of the metacarpal, metatarsal, and phalangeal bones. These cases are easily recognized.

I agree with the suggestion of Dr. Shipman that there may be dysfunction of the pituitary present in these cases. The defect exists before birth, and results in an impairment of the tissues during the course of development. On the other hand, in Marfan's syndrome, there is a bilateral ectopia lentis associated with an overgrowth of the long bones resulting in gigantism. This suggests

the possibility of a hyperpituitarism in these cases.

Dr. Robb McDonald. Several years ago while working in Dr. Adler's department at the University, we were also interested in the endocrine aspect of this disease. At that time Bachs, in England, had just published a paper on the hormones of the pituitary gland which he suggested as a diagnostic test in cases of retinitis pigmentosa.

We attempted to confirm that work and did three types of experiments. We injected hormones into hypophysectomized frogs in an attempt to see whether the Marfan's hormone had any effect on the frogs' pigment. We injected many times the normal dose of these hormones into gray rats in an attempt to produce pigment disturbances. That experiment likewise was negative. Finally, we obtained blood from around 87 patients and injected this into hypophysectomized frogs as a method for testing the hormone. In using hypophysectomized frogs the test was entirely negative, and the conclusion that we came to was that there was at least no relationship between Marfan's hormone, pituitary gland, and dispersion of pigment in the retina.

Marfan's syndrome in the E. family

Dr. Frank C. Lutman (by invitation) and Dr. James V. Neel, (by invitation) presented a paper on "The inheritance of arachnodactyly, ectopia lentis and other congenital anomalies in the E. family."

1. In a kindred of 40 persons there were 17 individuals who probably had Marfan's syndrome (arachnodactyly, ectopia lentis, indications of cardiac dysfunction, and other congenital abnormalities).

2. There is a great variability in the expression of the syndrome in the affected members of the kindred. In addition to classical cases, there exist in this family individuals so mildly affected that the diagnosis would be unsuspected or in doubt were it not for their genetic background.

3. Eye anomalies observed in all individuals studied, besides either ectopia lentis or coloboma of the lens, were abnormal suspensory fibers, an iris lacking in the usual surface trabeculae and crypts, deficiencies of uveal pigment (particularly at the periphery of the iris), and amblyopia. In several instances these anomalies were accompanied by other ocular defects.

4. The syndrome is inherited as if due to one or more dominant autosomal genes. Although a final decision is not possible, the bulk of the evidence suggests that the entire syndrome may be due to just one gene whose expression is greatly influenced by other genetic and possibly environmental factors.

5. In view of the threat to survival and reproduction imposed by Marfan's disease, it is felt that the syndrome would quickly disappear through natural selection unless there were a relatively high mutation rate from normal to the gene responsible for this syndrome. The many isolated cases which have been reported are thought for the most part to represent the results of this mutation process.

Discussion. Dr. James S. Shipman. I would just like to ask Dr. Lutman how many of the cases he has studied had retinal detachment. Two out of the last five cases of this condition which I saw had bilateral retinal detachment.

Dr. Frank C. Lutman. None of the individuals in the family had retinal detachments. However, the last six individuals with Marfan's syndrome whom I have seen have had some ocular surgery, and two of them had detachments. They were not related to this family.

Fluoroscopic X-ray screens

Robert H. Peckham, Ph.D., Temple University Medical School, said that X-ray screens have been greatly improved since they were first discovered, but further improvement requires ophthalmic research rather than chemical or physical research. This is because the screens must be modified from rod-stimulus screens to cone-stimulus

screens. The new cone-stimulus screens must be selected by their retinal effect, in terms of color, brightness, resolving power, and afterglow. Such new screens have been studied in this manner in the Department of Ophthalmology of Temple University Medical School, and we have been able to select new and improved screens from those prepared for these experiments by the United States Radium Corporation. These screens are being currently tried in the Temple Hospital, Department of Radiology.

The development of new techniques of accurately measuring visual response to these screens can be expected to yield new data of retinal physiology, in a form which may be applied to improved ophthalmic practice.

Discussion. Dr. Glen G. Gibson. I should just like to take this occasion to thank Dr. Peckham for the work that he has done and the interest that he has shown in this research program. Dr. Peckham has been unnecessarily modest in his presentation this evening, and the truth of what he has accomplished can best be learned from discussing this problem with Dr. Chamberlin who is using the new screens.

He states that the new screens have been a very definite advantage to them in the field of fluoroscopic diagnosis, and he is very enthusiastic, because it has helped him so much in a field which previously certainly has had much to be desired. In order to understand what really has been achieved, it is necessary to point out that one of the commercial companies who previously were making these screens had a monopoly for many years, and, the screens, as manufactured, were based on unsound physiologic optics. As a result of this monopoly, there has been for many years no definite progress made in this field.

Dr. Peckham's contribution is such that this monopoly has now been broken, and commercial companies are doing a number of things to help improve fluoroscopic X-ray screens. Dr. Peckham's work is not necessarily revolutional, but it is evolutional, and he has made real progress, and I anticipate that he will make even more as he carries on his studies.

Subzygomatic decompression for exophthalmos of cranial stenosis

Dr. Edmund B. Spaeth described subzygomatic decompressions for the exophthalmos of craniostenosis. A case presentation with a moving picture film (in color) showed severe bilateral exophthalmos with craniostenosis. Exophthalmos was so severe that surgical relief was necessary. The deformity of the orbit was so severe also that transfrontal orbital decompression through the roof of the orbit seemed to offer little, if any, relief. Subzygomatic decompressions were therefore done. There was a recession in the exophthalmos of the right eye of slightly less than 1 cm.; of the left of 4 mm. The left orbit was the more shallow of the two, although the exophthalmos on that side was no more marked.

Since the operation, the patient has been wholly comfortable, and there has been no recurrence of the spontaneous prolapse of the eyeball in front of the lids, a condition which had been distressingly recurrent prior to the surgery.

M. Luther Kauffman,
Clerk.

OPHTHALMOLOGICAL SOCIETY OF MADRID

February 13, 1948

Corneal opacities in infant

Dr. Marin Amat presented a case of total congenital opacities of both corneas in an infant girl, aged 20 days.

Marfan's syndrome

Dr. Marin Enciso presented a case of Marfan's syndrome in a 38-year-old man, with luxation of both crystalline lenses into the vitreous.

OPERATION FOR PTERYGUIM

DR. MARIN AMAT read a paper on "A preferred technique for the operation on pterygium." He explained the three general methods of operation: (1) Those which destroy the growth by cauterization or by diathermocoagulation; (2) those which employ a transplantation; and (3) those which employ excision either with or without covering of the excised area.

Outlining the concepts which should be observed in the operative technique so as to prevent a recurrence, Dr. Amat mentioned the importance of a general knowledge of the invasive and destructive character of the head of the pterygium, though it is benign and produces no metastases as has been shown by Arlt, Fuchs, and Redslob. He emphasized that his own experience has taught him that when the head is not completely removed, or the conjunctiva not well coapted, or the sutures tear out, the pterygium recurs.

The operative technique which he employs is basically this: Total extirpation of the head of the pterygium by tearing it off, excision of the body, perfect coaptation of the edges of the conjunctiva over the denuded area, and fixing of these edges to the sclera.

This is the mode of procedure: (1) Usual disinfection of the operative area; (2) repeated instillation of cocaine (4 percent) and adrenalin (1:1,000). Some cocaine (powder) is also placed directly on the pterygium so as to obtain perfect anesthesia without injecting novocain; (3) after adjusting the speculum, the neck of the pterygium is grasped and raised by the fixation forceps of Graefe; (4) By means of light traction in different directions the head of the pterygium is torn off from its implantation in the cornea; (5) thorough cleaning with a fine bistoury at the sclera near the cornea of the dense episcleral tissue which is found under the neck of the pterygium; (6) excising with fine straight scissors the end portion of the pterygium to the semilunar fold; (7) applying multiple silk sutures with a corneal needle—passing through the lower lip of the wound, through the thickness of the sclera, and through the upper lip; (8) perfect coaptation of the edges of the wound and tying the sutures; (9) making a U suture through both lids to make sure the lids cannot be opened; (10) placing a small amount of medicine on the outside of the eye and applying a bandage.

The sutures may remain until they fall out by themselves. If this does not happen, they should be removed, at the latest, in 9 or 10 days. When these steps are followed to the letter, the pterygium does not recur.

Discussion. Dr. Mario Esteban said that the proposed technique fulfills all the requirements of a good operation on pterygium; that is, complete extirpation, not so superficial as to leave some remains, nor so deep as to penetrate the thickness of the cornea and covering the denuded area by sliding the adjacent parts. This is better than applying a piece of labial mucosa which is unpleasant for the patient as it causes a defect in taste.

Dr. Garcia-Mansilla (D. Sinforiano) said that tearing off the pterygium from base to tip is the best procedure in order to avoid recurrence which is the common tendency of this affection. He has practiced this extirpation since he had seen it done by a distinguished oculist from Orotava. The cornea remaining clean cicatrizes easily, he uses only a few drops of methylene blue or of argyrol after the operation. As a degeneration of the corneal limbus is the probable origin of pterygium, he cauterizes this region with a galvanocautery. The sclera is completely covered by the sliding of the conjunctiva.

The extirpation of the pterygium is accomplished by dissecting from the base, then along the edges, and tearing off the tip, which removes it completely—an easy maneuver when the pterygium is membranous and a little more difficult when the tip is fibrous. With the modifications which

Dr. Marin advises, he believes the tearing off procedure is the best procedure for the cure of a pterygium. The operation should be done before the tip invades the pupillary region of the cornea.

Dr. Tomas Barraquer regards Dr. Marin's method the most logical and he is going to use it.

Dr. Marin Amat (in closing) thanked Dr. Mario Esteban for his discussion and said he was in accord with him regarding the bad effects on the sense of taste of transplanting labial mucosa. He thanked Dr. Garcia-Mansilla, his teacher, being in accord with him that tearing off the head of the pterygium removes it entirely, without the necessity of any other intervention (scraping, cauterization). Similarly, he believes, as does his teacher, that the danger of recurrence of the pterygium resides in the newly formed tissue which exists under the neck on the same level as the sclerocorneal limbus. For this reason he extirpates this tissue with forceps and scissors when it is abundant, or by scraping it off if it is of small amount. He also thanked Dr. Barraquer.

Headaches and ophthalmoplegia following tumor metastasis

Dr. Del Rio presented a 62-year-old man whose affection began with an intense trigeminal neuralgia, hemicranial and facial on the right side, which came in sudden attacks accompanied by nausea. The attacks increased in intensity and frequency. The past month, the right eye began to deviate inward and there was also a marked loss of hearing on the same side. A short time later the pains began to diminish as little by little a complete sensory-motor ophthalmoplegia supervened.

Analysis of blood and other body fluids were negative. X-ray photographs showed a deformity of the sella turcica by a posterior extrasellar tumor. General exploration of the patient uncovered an intestinal neoplasm. Under radiotherapy his condition improved a little, but shortly afterward his pains returned, although there was some improvement in the condition of his ocular paralysis (slight movement of the right upper lid, and of the internal, superior, and inferior rectus of the same side).

The fundus of the right eye showed slight peripapillary edema on the nasal side and slight pallor on the temporal side. The visual field showed slight bitemporal constriction. Vision was O.D., 1/8; O.S., 1/4, which could be improved to 1/2.

The intermittent neuralgia and this type of ocular paralysis lead to the diagnosis of ophthalmoplegic headache with sensory-motor ophthalmoplegia. The etiology is a carcinomatous metastasis through the blood stream. The localization is quite certain in view of the affected nerves being the 3rd, 4th, 5th, and 6th. It must be the zone where these nerves meet; that is, the middle cranial fossa, and more concretely the zone which has been called by Marin-Amat "zone of ophthalmoplegic headache (migraine)."

Discussion. Prof. B. Carreras Duran pointed out the fundamental difference between the ordinary and the ophthalmoplegic headache (migraine). The first usually attacks young people with hereditary tendencies and tends to improve in the course of time. Ophthalmoplegic migraine, however, usually attacks people of later age without hereditary tendencies and tends to get worse. Ophthalmoplegic headache has very different causes and is fundamentally different from ordinary headache. However, it is better to use an adequate term which we all understand than to substitute another term, perhaps more fitting, but which may create confusion in the terminology.

Dr. Marin Amat said that he has followed up five clinical cases and, as a result of his personal experiences, he has arrived at the following conclusions:

1. Ophthalmoplegic headache (migraine), a suitable term since it denotes pain and

ocular paralysis, is a syndrome which has a perfect cyclical development, which always begins with a neuralgia of the ophthalmic branch of the trigeminus, is followed by fleeting and transitory palsies of the ocular muscles, and afterward leads to sensory paralysis (anesthesia) and motor paralysis; the pain still persisting in contrast to peripheral anesthesia.

2. The condition, far from being frequent in young people as Charcot and the early observers held, is found most often in people over 50 years of age.

3. It is not due to functional disorders of any type but principally vasomotor (as the early authors believed), but is due to grave organic lesions, progressing to a fatal termination.

4. The motor nerve which is paralyzed first is usually the 3rd (4 out of his 5 cases), more rarely the 4th (the case of Dr. Del Rio and his own 5th case), after which follows paralysis of the other oculomotor nerves, including the optic nerve (blindness and sensory paralysis) and the 7th and 8th. The neuralgia and the ocular paralysis constitute the fundamental symptoms of the disease, to which are added a multitude of other symptoms that may be called complementary and may be considered as due to complications.

5. The clinical syndrome of the disease clearly indicates its anatomic localization (which Dr. Marin Amat calls the area of ophthalmoplegic headache) in the internal portion of the middle cerebral fossa or the cavernous sinus.

6. The predilection for the 3rd or 4th nerve in the beginning of the oculomotor paralysis is due to the location of the lesion in the external wall of the cavernous sinus, in which case the motor oculi is the first affected; or in the anterior of the same sinus in which case the 6th nerve is paralyzed first (observation of Dr. Del Rio); or the last mentioned nerve and the sympathetic in the plexus which surrounds the internal carotid artery in the interior of the sinus, as in the case of his own fifth patient, in whom, after the neuralgia of the 5th nerve, there supervened paralysis of the 6th and the sympathetic syndrome of Claudio Bernard-Horner, and, many months later, paralysis of the 3rd and 4th nerves. The autopsy revealed septic thrombosis of the transverse sinus and of the most posterior part of the right cavernous sinus.

Dr. Del Rio (in closing) thanked Dr. Carreras and Dr. Marin Amat and said that he was in accord with Dr. Carreras that the term "ophthalmoplegic headache" does not correspond to a clinical reality of a unique and well-defined etiology, in contrast to what occurs in ophthalmic headache, which is a true nosologic entity. If he had seemed to prefer this term in the case presented, it was in order to conserve the classic terminology of Charcot.

Joseph I. Pascal,
Translator.

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THE BRITISH INSTITUTE OF OPHTHALMOLOGY

The British "Institute of Ophthalmology" was formally opened on November 4, 1948. It becomes the research and postgraduate teaching unit for ophthalmology of the University of London.

The new Institute was the result of the University of London assuming responsibility for three London ophthalmic hospitals—Moorfields (The Royal London Ophthalmic Hospital), the Westminster Eye Hospital, and the Central London Eye Hospital. All clinical work—beds, outpatient departments, operating theaters, and so forth—were concentrated in Moorfields and the Westminster Hospital. The Central was completely remodeled as a research and postgraduate teaching unit. Representing a radically new development in British ophthalmology, it may well be considered an expression of a policy for the encouragement of specialized research and postgraduate teaching in the new medical program of Great Britain.

The Institute is located in Judd Street near Kingscross. The building is 110 feet in length, 84 feet in depth, and 68 feet in

height and consists of four floors and basement. The basement is divided into the cafeteria, service rooms, students commons, and locker rooms, and four separate workshops for the development of special scientific equipment.

The first floor contains the administrative and dean's offices, the orthoptic instruction department, and large and well-equipped rooms for the instruction of postgraduate students and the reception of special patients, referred from the hospitals, who provide the material for clinical instruction. These quarters provide ample space for instruction in the various branches of clinical ophthalmology—external diseases, ophthalmoscopic examination, slitlamp work, perimetry, gonioscopy, and so forth. The equipment is all new and thoroughly modern.

The second floor contains the director's offices, committee commons and staff rooms, laboratories for embryologic, anatomic, and clinical research, a beautifully equipped photographic department, and living quarters for the resident engineer.

The third floor consists of a lecture room seating slightly over 100 persons, the library, and a six-room research unit, three of which are devoted to industrial illumination investigation.

The third and fourth floors are unusually impressive and consist of beautifully designed and splendidly equipped research laboratories. On the third floor is a large allergy laboratory under the immediate direction of Dr. David Harley, extensive clinical and research pathologic and bacteriologic laboratories, with all usual accessory preparation and media rooms, under the direction of Dr. Norman Ashton, and a suite of laboratories which house a portion of the visual-research unit.

The fourth floor consists of the major portion of the visual-research unit, and the physiologic laboratory. The visual-research unit is a project of the Medical Research Council for the study of ocular neurophysiology, and is essentially an independent project under Professor Hartridge, the administrative control only being the charge of the director of the Institute.

The physiology laboratory, on the other hand, while also a Medical Research Council project, is an integral part of the Institute, both the research and administrative responsibility being in charge of the director. The present investigations of the physiology laboratory are centered chiefly on studies of the blood-aqueous barrier, in which Dr. Davson and Sir Stewart Duke-Elder are engaged. A special balance room, animal rooms of various types, and accessory rooms complete the layout.

In designing the Institute, both the architects and the director have been farsighted in constructing remarkably flexible and adjustable teaching and research units. Provision has been made for additional animal rooms to be made available as the occasion may demand. The various laboratories flow harmoniously one into the other, and thus permit the ready expansion of any particular unit which increasing investigation may require, and the immediate utilization of laboratory space no longer needed for any particular project. Too much cannot be said for the meticulous care for detail which has gone into the construction of the various individual laboratories, while, at the same time, the overall conception of an institute devoted to ophthalmic research has been admirably preserved. The equipment is all new, modern, extensive, and elaborate. There is a conspicuous absence of the antiquated junk that litters so many research laboratories and institutions.

Sir Stewart Duke-Elder, well known, admired, and loved by American ophthalmologists, is the director of the Institute. He alone has been responsible for the concept of the Institute, for the inception and execution of plans, and for the final crystallization of these into the present reality. It

is truly a monument to his indefatigable energy, his broad concept of investigative ophthalmology, and his administrative genius.

The potential influence of the new Institute on British, and indeed on world, ophthalmology is enormous. Primarily, as concerns teaching, it must be remembered that in England the term "postgraduate teaching" is used in quite a different manner than in America. In England, postgraduate teaching covers the period between graduation from the medical school and final qualifications of the candidate as an ophthalmologist through the passing of his final fellowship examination. In America, this period of training is usually referred to "graduate" instruction, "postgraduate" instruction implying that supplied by agencies such as the various refresher courses and the American Academy instruction program.

The instruction furnished in the Institute of Ophthalmology covers the English "postgraduate," or the American "graduate," teaching period. The faculty consists not only of the full-time staff of the Institute, but also of a group of distinguished London clinical ophthalmologists who hold teaching chairs in the various component schools of the University of London. The student body is chiefly the large group of embryonic ophthalmologists who are receiving their preliminary clinical training as outstudents of Moorfields. Every possible aid for clinical instruction is provided in the Institute. The one apparent weakness in the teaching setup is the remoteness of the teaching center from the clinical centers at Moorfields and the Westminster. The defect, which is quite impossible to overcome now, is fully realized by the director and governing board of the Institute, and it is planned to rectify this by the later construction either of a new combined center, or of a large contiguous clinical unit. For the time being, the clinical material necessary for instruction is provided by the transportation of selected patients from Moorfields and Westminster. Each morning, at the entrance of the Institute, is posted the day's program of lectures, laboratory work, and clinical instruction. It is a formidable schedule, and indeed a challenge to American teaching institutions.

The research program is also most impressive. The two major projects under active investigation are the study of the mechanism of color vision by the single nerve-fiber technique and the study of the physiology of the intraocular secretion.

The first of these, under the direction of Professor Hartridge, is largely a continuation and extension of Grannit's fundamental observations, and is quite similar to comparable studies in ocular neurophysiology now in progress in several American clinics. The second project is the logical continuation of Duke-Elder's earlier work on the blood-aqueous barrier. Radioactive isotopes are being used in this work.

These two major pieces of investigation, under the direction of already distinguished scientists, need no comment. That they will result in important advances in our knowledge of the basic physiology of vision and of the intraocular secretion is assured.

Both the pathology and allergy laboratories carry rather heavy clinical loads in addition to their contemplated research programs. The surgical pathology and routine bacteriologic work of both Moorfields and the Westminster are the responsibility of the pathologic laboratory of the new Institute. From American standards, the routine bacteriologic work, entailing cultures of the conjunctival flora on every patient admitted for operation in the two clinical hospitals and a consequent minimum delay of 48 hours for every operation, seems possibly a somewhat unnecessary procedure and delay. One wonders if this procedure may not be the result of tradition or the remnant of a habit, rather than a preoperative safeguard for the patient. Certainly the value of cultures from white, nonirritated eyes, especial-

ly when taken on blood-agar slants rather than plates, is a debatable question from the clinical and bacteriologic viewpoint!

The personnel in charge of these laboratories is most interesting. Rather than appoint clinical ophthalmologists who have special interest in ophthalmic pathology, bacteriology, and allergy, but who are nevertheless primarily clinicians, Sir Stewart Duke-Elder has appointed young but experienced general pathologists and allergists to the charge of these laboratories. These men, Dr. Ashton and Dr. Harley, now take up the task of devoting their broad general training to the study of the special pathology, bacteriology, allergic, and immune reactions of the eye, and plan henceforth to specialize in these fields. The rather radical decision of the director seems a most happy one, and these departments, under such able leadership, should wield a most refreshing influence on ophthalmic science.

The proposed experimental investigations of these departments are such things as a study of the course and anatomic distribution of the retinal nerve fibers by the method of local retinal injury and the study of the resulting ascending degeneration by the Marchi technique, genetic studies on mice with a congenital pigmentary degeneration of the retina, and a most interesting study of the optic-nerve changes in glaucoma. In this last study, arrangements have been made to utilize the postmortem material available from the large asylum population of London, and to study not only the local changes in the optic nerve of all glaucoma patients dying in these institutions, but also to study the extension of the degenerative process in the central nervous system.

The studies planned in the allergy clinic comprise, among other clinical studies, an investigation of the role of bacterial hypersensitivity in focal infection through a rather ingenious screening process of the autogenous flora. Further fundamental research problems will be added to this already broad program as proper personnel becomes available and is developed. There is fortunately ample laboratory space available for further development and extension of investigation.

The question of the future personnel for ophthalmic research is an interesting one. It may well be asked if the present program for training ophthalmologists in England is calculated to encourage the development of investigators. This program now entails, after graduation from medical school, a general internship, and then, when the decision to specialize has been reached, a period of further study in the basic sciences, anatomy, pathology, and physiology before the future ophthalmologist is qualified for his preliminary fellowship examination in these general subjects.

With these finally out of the way, the candidate then begins his preliminary training in clinical ophthalmology, as an extern or student in the large ophthalmic hospitals. From this pool of externes are chosen the house officers for Moorfields, the Westminster, and outlying institutions. At the completion of a two-year resident training, the candidate then has a further period of roughly one year's study before he is qualified to take the final fellowship examinations, after the passage of which he is considered to be a qualified ophthalmologist available for hospital appointment.

Will this long, prescribed clinical training develop individual initiative and foster investigative genius? Certainly this new Institute will encourage such ends, providing an outlet and facilities for any research problem in which the budding ophthalmologist may become interested. The New National Health Act, which goes a long way toward equalizing the financial returns of clinical and research work, will also help toward the goal of encouraging proper men to continue in research, rather than be weaned away by the greater remuneration to be obtained from practice. Thus these two agencies,

the new Institute and the socialized medical program, conceived with radically different aims, may ultimately work toward the same end. There is also always the possibility that the present system of ophthalmic training, which has been developed over centuries and is old in tradition, may be modernized and simplified. In any event, the completion of this new Institute is a step forward to this end.

The inaugural exercises of the Institute were held in the lecture hall of the Institute. Attendance at the opening lay-professional meeting was restricted to specially invited guests on account of the limitation of space. Large overflow meetings were held simultaneously in the basement and first floor, and the program convoyed there by microphones and loud speakers.

The opening address was delivered by the Earl of Rothes, the chairman of the Board of Governors both of the Institute and the clinical hospitals, who ably outlined the sequence of events which led to the foundation of the Institute, its incorporation as an integral part of the University of London, its present scope, and plans for the future.

Lord Rothes's address was followed by three short addresses from three specifically invited speakers—Sir John Parsons speaking for British ophthalmology, Dr. Alan C. Woods for American ophthalmology, and Professor Weve, of the University of Utrecht, for Continental ophthalmology.

Following this lay-professional meeting, tea was served, followed by the inaugural lecture by Dr. Woods. In the evening there was a large banquet attended by the faculty and governors of the University of London, by the medical profession, and by friends of the new Institute. Lord Rothes acted as toastmaster and the concluding speech of the evening was made by the new director, Sir Stewart Duke-Elder, who modestly told of the various problems of the new Institute and outlined his plans for its future.

Too much credit cannot be given to Sir Stewart Duke-Elder for the conception and completion of the program which has eventuated in this new Institute, or to Lord Rothes, who, as chairman of the board, worked tirelessly for the success of the program. It was Duke-Elder's original idea to move Moorfields and the other London eye hospitals from the category of independent eye hospitals and to merge them, as the Department of Ophthalmology, into the huge teaching cosmos of the University of London.

Not content with this alone, he took advantage of every loophole and foothold in the New National Health Act to bring into reality his dream of a research and postgraduate teaching institute. That he encountered opposition from both ophthalmic clinicians and from governmental sources is needless to say. That this opposition was successfully overcome and that the new Institute was finally completed and launched is a monument to his untiring effort, his patience, his tact, and his firmness. British and world ophthalmology owe him a great debt for this signal contribution to the advance of ophthalmic science.

Alan C. Woods.

RESIDENCIES AND THE BOARD

Numerous questions received by the American Board of Ophthalmology show a rather widespread misapprehension of the board's attitude in the matter of ophthalmic residencies and seem to call for a statement in clarification of the aims and methods of the board.

The board was founded for two purposes: one was to set up standards and conduct examinations to determine the fitness of candidates to practice ophthalmology; the other was to improve the teaching of ophthalmology.

It was not a function of the board to determine how a candidate should prepare himself, not their province to decide through what door he might enter the field, but only to find out that he had in some way qualified himself to meet the standards they established.

Not rarely a man who had had the benefit of a Class-A school and a Class-A residency was found, on examination, to have made such poor use of his excellent opportunities as to be poorly qualified, while quite as often a man who had had a Class-C or Class-D school and residency was found to have made such good use of his meager opportunities and to be so admirably equipped as to demonstrate on examination that he was well qualified.

Hence the board, while recommending the choice by the student where possible of a Class-A residency, could not make it a cast-iron requirement that a candidate *must* obtain his training in one of a selected list of residencies or else he would not be given an examination, and of course not a certificate. The board, therefore, cannot "accept" a given residency in the sense that it binds itself to accept candidates so trained.

Moreover, the board has no system of credits; for example, so much for college degree, so much for internship, so much for residency, so much for preceptorship, so much for each year of study or practice, so much for each subject of the examination, written, or oral, or practical.

Therefore, to inquire whether the board will give credit for this or for that is beside the point—the board neither gives nor withholds credit. The board has certain requirements all of which must be met. They include a certain minimum length of time devoted to study, hospital, laboratory, clinical, and private practice, the adequacy of which must be demonstrated by passing the examinations. Walter B. Lancaster.

BOOK REVIEWS

OPTOMETRY: PROFESSIONAL, ECONOMIC, AND LEGAL ASPECTS. By H. W. Hofstetter. St. Louis, C. V. Mosby Company, 1948. 400 pages, index. Price, $6.50.

The author in his preface states that "This book is intended as a reference and text for use in undergraduate courses in optometry designed to familiarize the student with various non-clinical aspects of the practice of optometry, such as jurisprudence, economics, history, professional and inter-professional relationships, educational and organizational problems, practice-management, ethics, and general civic and sociological problems of vision and eye care."

The ophthalmologist will find it of much interest. It is well written and, for the most part, factual, and contains a wealth of information about the nontechnical aspects of optometry that is reasonably unbiased. Its philosophy is inclined to the premise that optometry is a profession and not a trade, although a large majority of the optometrists still peddle their services and wares on the radio, newspaper, neon sign, and street-car advertisement level.

As a consequence, this book contains a lot of propaganda, needling the recalcitrant tradesmen to get religion. It also does some whistling in the dark.

The author goes to some length to point out that the optometrist is qualified by his training to act as an expert witness on all ophthalmic problems in court, at the same time emphasizing that legally he is not responsible for the recognition and diagnosis of ocular diseases. What a curious paradox this is. In effect, it means that the optometrist is paid an expert's fee for discussing glaucoma in the same court in which he would not be held responsible for missing the diagnosis in the case of one of his customers.

Of particular interest to ophthalmologists should be the chapter (XXII) on "Medical eye practitioners." Here the ophthalmologist will learn of the lowly origin of his own specialty, the "itinerant quacksalvers"; and of the opposition of our medical colleagues to our specialty.

If this is not surprising enough, there are the definitions, "an ophthalmologist is a physician certified by the American Board of Ophthalmology"; an oculist is "a physician without special certification who limits his practice to the care of the eyes"; and the E.E.N.T. specialist is "a physician without special certification who limits his practice to the care of the eyes, ears, nose, and throat."

The ophthalmologist will be particularly surprised to find that the reason why optometry is not acceptable to him is because of the economic competition involved, in spite of the fact that it is well known that 80 percent of the people with visual symptoms see the optometrists, and in spite of the fact that every ophthalmologist is severely overworked.

There is little consideration given to the idea that the chief reason for objecting to optometrists is that they are not competently trained to recognize ocular diseases and pathologic conditions, thereby exposing the public to exploitation and to the risk of blindness.

Chapter VII, "The title 'doctor' and designations other than optometrist," will likewise prove of interest and deserves careful reading. The following paragraphs are reproduced for your information.

"The prime reason that the optometrists want the doctor degree is that the public expects a person who examines eyes to be a doctor; i.e., the public automatically puts the optometrist in a category with the dentists and physicians. If he uses the title, no questions are asked; if he does not employ the title, he is repeatedly requested to explain why.

"Furthermore, the title has been used for centuries as a means of designating a higher degree of learning in various fields, such as theology, law, and science, as well as in medicine; and, therefore, the title inspires confidence on the part of the public that the holder knows what he is doing. Proper rapport between the patient and the optometrist is quite essential and it is probably justifiable to make use of the title to help induce proper rapport."

That this claim is modest is, of course, apparent. Think how much prestige the optometrists would have had if they were all called "Professor." Perhaps they can be persuaded to adopt this title. It would save the ophthalmologist much trouble in explaining to the people and even to his medical students, what the difference between "ophthalmologist" and "optometrist" really is.

The "professor" who plays the piano "downstairs" while the "profession" practices "upstairs" is in a good position to put the customers in a state of proper rapport.

Derrick Vail.

OFFICE TREATMENT OF THE EYE. By Elias Selinger, M.D. Chicago, The Year Book Publishers, 1947. 542 pages, 67 illustrations, index, chapter bibliography. Price, $7.75.

Dr. Selinger's book was published only shortly before his untimely death, and is now both a valued legacy to his confreres and a fitting memorial to his memory. The delay in the presentation of this review, for which the JOURNAL apologizes, permits a perspective that shows its high points of quality in bolder relief. The volume, intended for the indoctrination of residents in ophthalmology, is still full of novel and valuable hints for the seasoned practitioner. The material is well organized, minutely detailed, and clearly illustrated. Selinger's own contributions, such as the quinine bi-

sulfate treatment of trachoma and his technique for iontophoresis are lucidly recorded. Much ophthalmic surgery is carefully described that could be done in a properly equipped office operating room, and, indeed, if the present hospital situation continues, minor surgery and emergency procedures could be handled better with such an arrangement.

Certain statements are open to question, such as "in congenital cataracts needling can be performed safely between three and six months of age." It is an error to suggest to glaucoma patients the self-instillation of drops in the lower fornix. Although this method is generally satisfactory for conjunctivitis, it does not insure adequate absorption. Where self-administration of miotics or mydriatics is necessary, the patient should lie supine, bring the dropper above his eye, and let the drop fall on the cornea. In the description of stellate retinopathy, no mention is made of the pseudoalbuminuric retinitis of Leber that follows edema of the macula due to trauma or other cause, while Duke-Elder reserves the term for this particular entity.

Ophthalmic therapy, in spite of its importance, has only within recent years received adequate special attention. American ophthalmology has moved far toward the Hippocratic ideal of making therapy "certain, speedy, and comfortable." Some definite advances are not included in even this latest compilation. Sulfonamide therapy has been improved by administering the most effective representatives in combination—"triple sulfonamides." Tuberculin testing has become more general through the convenience of the Vollmer patch test. The instillation of histamine phosphate (1:1,000) has helped control episcleritis. The new plastic lenses are more protective than the laminated or tempered variety. As an occlusive contrivance, the rubber suction occluder of Jamieson is superseded by the Bel-occluder.

Although Selinger advocated the conventional skin incision for acute dacryocystitis, the operation of Agnew, revived by Verhoeff and described in the *American Encyclopedia of Ophthalmology*, is far preferable. It requires only a preparation similar to that for probing. A keratome, placed anterior to the caruncle, enters the sac and releases the pus. Immediately after, a No. 14 probe, easily passed into the nasolacrimal duct, secures adequate drainage. For lymphangiectases of the bulbar conjunctiva, Selinger suggests incision, but obliteration by galvanocautery is as easy and more effective.

Because of the author's decease this book is unlikely to be published in a succeeding edition. It is to be hoped that whatever is excellent and permanent will, nevertheless, be perpetuated. James E. Lebensohn.

LE FOND D'OEIL DES HYPERTENDUS ET DES CYANOSÉS. (The ocular fundus in hypertension and vascular congestion.) By Daniel Routier. Paris, Masson et Cie, 1947. 100 pages, 232 figures. Price, 1,350 francs.

The author, who is a cardiologist and not an ophthalmologist, has succeeded in providing us with a valuable book, consisting of his observations over many years of his numerous patients with heart disease and vascular hypertension.

The illustrations are beautiful black and white photographs of the ocular fundus taken with the Nordenson reflex-free camera. They are well chosen. Accompanying the plates are fine descriptions of the lesions seen and the interpretation of them from the author's viewpoint.

This approach, seldom encountered by the ophthalmologist, will intrigue him and will yield much information of value to him. Few ophthalmologists are experts in vascular diseases and find the meaning of what they see with the ophthalmoscope difficult,

at times, to interpret and to understand. Those who read French will, therefore, find it profitable to obtain and study this excellent book. It is a credit to postwar French book-making. Derrick Vail.

TRANSACTIONS OF THE OPHTHALMOLOGICAL SOCIETY OF PARIS (and of the Ophthalmological Societies of the East, of Lyon, and of the West). Meeting of January, 1948, pp. 1-34; meeting of February, 1948, pp. 34-80.

At the January scientific session six papers were read and discussed. Parfory and Polliot presented two case histories describing glaucoma attacks in eyes which had subconjunctival fistulas. Both attacks occurred after surgery on the second eye, immediately in the first case, much later in the second. This phenomenon was ascribed to a swelling of the vitreous body after trephination.

Jean Gallois reported on three cases of juvenile glaucoma. The patients had all the classical signs and symptoms of chronic, simple glaucoma but did not develop buphthalmos. A detailed study of the tonometric readings and visual fields seemed to place these cases in the preglaucoma group.

Fournie and Offret presented a patient in her thirties who, years ago, had had an enucleation and now was worried by protrusion of the prosthesis. This protrusion was caused by a fibrous granulation tissue around numerous crystals, probably derived from the enamel of the prosthesis which the patient had not removed for three years.

Begué reported a patient who had had recurrent attacks of tenonitis that increased in severity during six years. Later, subretinal edema and detachment occurred, followed by hypertensive retinal disease. At first, there was no renal involvement but uremia developed before death. A hyperactive suprarenal gland could have caused a disturbance in the chloride metabolism resulting in edema, tenonitis, and detachment. Hypertension could have resulted from overproduction of hormones of the anterior lobe of the pituitary and this, in turn, could have stimulated the suprarenal glands and finally produced retinal and renal sclerosis.

Toulant read the lecture of Benhamous and Toissin on examination of the fundus in tuberculous meningitis and on the results of streptomycin therapy in 25 cases of tuberculosis. Disc changes were present in 18 patients; 17 had papillitis, one, optic atrophy. Out of 12 patients examined, 7 had chorioretinitis. None had motility disturbances. The disc changes, which were more inflammatory than edematous, were essential to the diagnosis.

Joyle, Ourgand, and Berard discussed three trachomatous patients who, in spite of severe corneal lesions, had had keratoplasty. The postoperative course was stormy, with bulging of the transplants. One patient had a good result.

At the February meeting, Gallois amplified his previous communications on the difference between visual fields undisturbed by facial structures and those limited by protrusions of the face. The perimeter and the head were immobilized, and the fixation point was out 30° to 45° from the center in different meridians.

Schiff-Wertheimer, Jonquères, and Jarry presented a patient with severe monocular papilloretinitis, normal visual acuity, without any signs of intracranial hypertension but with a progressive, large scotoma in the upper field. The value of campimetry in low illumination was emphasized.

Hartmann and Rossano reported on their study of retrobulbar injections of sodium nicotinate in retinal vascular disease. They had 9 cases of obliteration of the central retinal artery, 9 of thrombosis of the central

retinal vein, and 4 of retinal arteriosclerosis. A delayed success from this treatment is possible in embolism of the retinal artery. Better results were obtained in thrombosis of the retinal veins when sodium nicotinate simultaneously relieved the spasm of the retinal arteries and changed the circulation.

Nectoux observed three cases of hypertensive uveitis associated with alveolar pyorrhea. When treated with penicillin, the patients improved in a comparatively short time.

The signs, symptoms, and treatment of acute Bacillus coli infection of the conjunctiva were discussed by Ghavam Sadanghi. This infection occurs most frequently in children and heals without sequelae.

Reports on the III Pan-American Congress of Ophthalmology in Havana are also included in this issue of the Transactions.

Alice R. Deutsch.

EXPERIMENTELLE UNTERSUCHUNGEN ÜBER FARBENGLEICHUNGEN IM ZENTRALEN UND PARAZENTRALEN SEHEN. By G. F. Olsson. Dissertation for the degree of M.D. Stockholm, Centraltrykkeriet, 1948. 153 pages. Price, Kr. 12.

In this experimental examination of the color equations in central and paracentral vision, the author takes issue with the generally accepted theory that the yellowness of the macula is responsible for the discrepancies noted between the complementary color curves in central and paracentral vision. In an intensive investigation with the Gullstrand spectrophotometer reliable reactions were secured by substituting for the gypsum mirror of the instrument a metallic-wire lamp provided with alabaster glass. From his comprehensive study, which can be fully appreciated only in the original complete text, the author concludes that the alteration of the complementary curves is solely due to the participation of paracentral vision which significantly affects color tone. The monograph concludes with a detailed bibliography and diagrams illustrating apparatus and the various color curves of previous experimenters in this field.

G. W. Keyser,
Oslo, Norway.

A CLINICAL HANDBOOK OF STRABISMUS. By George J. Epstein. Philadelphia, The Blakiston Company, 1948. 224 pages, 123 illustrations, index. Price, $5.00.

The author has assembled in a compact and satisfactory fashion, useful information regarding the extraocular muscles and their dysfunction. It is pleasing to note that he approaches the complex and still controversial subject of strabismus from both the objective (Duane, White) and the neuromuscular (Bielschowsky, Lancaster, Adler) viewpoints.

It is obvious also that the author is a follower of Chavasse, whose teachings are still not entirely accepted.

There are many excellent and instructive illustrations, and the text is adequate. The publishers have done a splendid job. It is recommended reading.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

7

CONJUNCTIVA, CORNEA, SCLERA

Colombo, G. L. **Rickettsia-like bodies in keratoconjunctivitis nummularis epidemica.** Boll. d'ocul. 27:290-398, June, 1948.

Intracellular and free Rickettsia-like bodies were found in conjunctival smears from eyes with epidemic keratoconjunctivitis nummularis. The smears were stained with Giemsa-Romanowski solution and photographed. The morphologic characteristics and their resemblance to inclusion bodies and to Rickettsiae are discussed. K. W. Ascher.

Edeskuty, Otto. **The use of keratoplasty in pterygium.** Klin. Monatsbl. f. Augenh. 110:48-52, Jan.-Feb., 1944.

Keratoplasty, recommended by Friede against pterygium, seems less effective and much more complicated than the operation described by the author in 1934. The essential cause of the pterygium is the proliferation of the subconjunctival connective tissue, and as long as this is not thoroughly removed, a recurrence is to be expected. After removal of the pterygium from the cornea the subconjunctival tissue together with the conjunctiva is separated from the sclera up to the insertion of the rectus. Then the subconjunctival tissue is dissected from the conjunctiva, cut off, and the thin conjunctiva is put back into place and secured with two sutures. There are no recurrences, if the operation is properly performed.

George Brown.

Forsyth, W. B. **The treatment of syphilitic interstitial keratitis.** South. Med. J. 41:1015-1022, Nov., 1948.

A simplified program for the treatment of luetic interstitial keratitis is presented. Typhoid vaccine is used three times a week. The initial dose consists of 250,000 organisms per pound of body weight but no more than 20 million organisms. If the fever lasts four hours and does not exceed 103 degrees, the dose is then doubled; a poor response requires between two and three times the preceding dose. If a triple dose is given, the dose should be tripled in each succeeding injection until a good response occurs. There is little need for going above 12 billion per treatment. Patients who weigh over 65 pounds are given 3.4 million units of penicillin in doses of 40,000 units every 2 hours; those under 65 pounds 50,000

units per pound of body weight divided into 60 injections. In 88 percent of 70 cases useful vision was restored. Penicillin plus fever therapy results in a more prompt recovery. I. E. Gaynon.

Friede, R. **The problem of autokeratoplasty with rotation of the graft.** Klin. Monatsbl. f. Augenh. 110:33-48, Jan.-Feb., 1944.

An optic iridectomy to improve vision in the presence of a dense corneal scar is a simple but often not very effective operation. It probably will be replaced by the transplantation of the cornea when the latter seems safer. In transplantation with rotation a larger graft is cut out with its central portion in the scar and its peripheral part in the surrounding clear cornea. The graft is then rotated until the clear portion comes to lie in the center of the cornea. The graft should be of the whole thickness of the cornea. The operation is indicated in sharply outlined central scars and clear periphery. In 78 cases of rotating transplantation done 5 to 17 years ago, the author has not lost a single graft. The autoplasty, though little appreciated even in textbooks, has several advantages. Opacification of the graft is less frequent than in homoplasty. The technique is simple. Healing is smoother. One disadvantage is the larger size of the graft and this could be obviated by a rectangular graft. Friede believes that autoplasty will be at least the equal of homoplasty in the future.

George Brown.

Friedman, Benjamin. **Therapeutic sulfadiazine poisoning, with pemphigoid lesions.** Arch. of Ophth. 38:396-805, Dec., 1947.

Three cases of sulfadiazine poisoning resembling acute pemphigus are reported in detail. The conjunctival lesions consisted at first of large ulcerations, conjunctival thickening and formation of cysts, and then of extensive scarring. The initial ulcers healed. Later, small circular ulcers of the palpebral conjunctiva, with undermined epithelized edges appeared and persisted for well over six months. The cornea was not affected. Treatment was symptomatic.

John C. Long.

García Miranda, Ramón. **Observations on a case of tuberculous conjunctivitis treated with streptomycin.** Arch. Soc. oftal. hispano-am. 8:747-752, July, 1948.

Garcia treated a case of hypertrophic, nodular, palpebral conjunctivitis with caseation with subconjunctival injections of a solution of streptomycin, containing 10,000 units per cc. The diagnosis of tuberculosis was established histologically. The pain of the injection was lessened by the addition of a weak solution of novocain and adrenalin to the antibiotic. The diseased area and the entire superior fornix were infiltrated with the solution, and the injections were combined with instillations into the conjunctival sac. A complete cure was attained after the injection of 120,000 units. (2 photomicrographs.) Ray K. Daily.

Giardini, A. **Deep, pustular, luetic keratitis (Fuchs) and its treatment with large doses of penicillin.** Rassegna ital. d'ottal. 17:254-258, July-Aug., 1948.

A luetic patient, 57 years of age, had a typical deep pustular keratitis, the result of an injury six weeks before. An exudate which completely filled the anterior chamber was extracted in its entirety after a paracentesis and from it the treponema and Koch bacilli were recovered. The lesion was completely cured in ten days as the result of the injection of 4,800,000 units of penicillin, two subconjunctival injections of 10,000 units each, and an ointment of penicillin used

every three hours. The iridocyclitis complicating the keratitis cleared promptly.
Eugene M. Blake.

Marín Amat, M., and Marín Enciso, M. **A pigmented naevus associated with a pterygium.** Arch. Soc. oftal hispano-am. **8**:839-841, Aug., 1948.

A woman, 48 years old, presented herself with a thick, vascularized pterygium on the nasal side of the left eyeball, which had in its upper portion a pigmented spot 2 mm. in diameter. For 30 years she had had a stationary dark spot in the conjunctiva of that eye; two years before, it began to increase in size with the development of the pterygium. The pterygium was extirpated, and on histologic examination the black spot was found to be a naevus. Ray K. Daily.

O'Reilly, G. **Penicillin in the treatment of serpiginous corneal ulcers.** Arch. chilenos de oftal. **4**:377-382, Jan.-Feb., 1947.

Deep suppurative corneal ulcers, not favorably influenced by sulphamides, are benefited by local penicillin injections, or especially poultices placed in the depth of the lower cul-de-sac. The therapeutic result is better with the poultice than with the subconjunctival injection. The author suggests that the result with the poultice may be improved by augmenting frequency of application, and perhaps by further study of the ocular conditions in relation to depletion of penicillin. (References.) W. H. Crisp.

Orzalesi, F. **Corneal changes originating in the endothelium and in Descemet's membrane; certain types of keratitis caused by these changes.** Boll. d'ocul. **27**: 237-323, May, 1948.

After discussion of the changes observed on the posterior corneal surface, Orzalesi describes two patients clinically and one of them histologically. The specimens were obtained during corneal transplantation which was performed on both eyes of one of the patients, a 52-year-old woman. Her right eye became "less clear" in 1941; when she was seen in the Cagliari University Eye Clinic in 1943, its vision was only 1/6 because of corneal edema and an annular bedewing of the posterior corneal surface. Three years later, the formerly normal left eye showed a similar picture and the right had a completely opaque yellowish gray anesthetic cornea with normal anterior surface and only light perception. A general physical examination was essentially negative and treatment was of no avail. In 1947 both corneas looked like large leucomatous scars and therefore the corneal transplantation was performed. The excised discs showed an enormous thickening and an unusually soft consistency. They were examined in frozen sections for study of the lipoid content and in paraffin sections. The visual improvement after keratoplasty, initially as high as 8/10 in the better eye, soon fell to 2/60 and 1/40. The second patient, also seronegative, showed less pronounced opacities in one eye only. Orzalesi assumes that in both patients a herpetic infection involving first the endothelium and later the epithelium and the parenchyma of the cornea was the primary cause of the corneal disease. (15 figures, 49 references.) K. W. Ascher.

Pasca, G. **Statistics concerning the results of trachoma therapy by sulfa drugs.** Boll. d'ocul. **27**:383-390, June, 1948.

Tables show the occurrence of trachoma in the public schools in the province of Sassari, Italy, during the years 1922 to 1948, the stages and complications of the disease observed in the years 1917 to 1947, and the incidence of operations for entropion during the years 1931 to 1947. From these tables it is evident that although the occurrence of the disease

has not diminished since the introduction of the sulfonamides the frequency of complications has been considerably reduced. During the period of observation no sulphonamide resistance has been encountered. K. W. Ascher.

Paton, R. T. **Corneal transplantation.** New Orleans M. and S. J. **101**:25-29, July, 1948.

A brief review of the history of keratoplasty beginning with Pellier in 1789 is given. Fourteen authors and their major historical data are mentioned.

Selection of patients depends upon their environmental factors, their physical condition and age and their psychologic and medical condition. Transplants in the very young are to be avoided because of the difficulty of avoiding infection and trauma during change of dressing. No scarred cornea should be operated upon if an iridectomy will bring about improvement in vision. There is no disadvantage in first doing an iridectomy when in doubt. The most favorable cases are those in which there is a nebulous opacity in an otherwise normal eye. Patients with conical cornea are urged to wear a contact glass if they can be comfortable and obtain vision better than 20/200. Glaucoma and adherent leucoma should be operated on before one attempts a corneal transplant. Corneal dystrophies are usually unfavorable. Eyes with desemetocele and old tattooed scars usually do well if there is little corneal vascularization. The operative technique and postoperative care are described completely.

H. C. Weinberg.

Paton, R. T., McLean, J. M., Castroviejo, R., Maumenee, A. E., Kornblueth, W., Owens, W. C., Frank, J. J., Leahey, B., Messier, P. E., Scheie, H. G., Vincent, B. R., Wandworth, J. A. C., and Stansbury, F. C. **Symposium: corneal transplantation.** Am. J. Ophth. **31**:1365-1399, Nov., 1948. (28 figures, 5 tables, 36 references.)

Pillat, A. **Additional report on the epidemic of keratoconjunctivitis in Styria in 1942.** Klin. Monatsbl. f. Augenh. **110**:52-56, Jan.-Feb., 1944.

The author and others observed 336 more cases to add to the 160 cases reported in 1943. The disease started as an acute catarrh with serosanguinous discharge. The preauricular and occasionally the submaxillary glands as well were involved in 80 percent of the cases. The cornea became affected after 6 to 12 days. Vision was, with few exceptions, almost or completely restored. Re-infection did not occur. The possibility of spread by contact was established. In the first two months of 1943 only one more case was seen. G. Brown.

Ríos Sasiain, M., and Valle Jiménez, A. **Studies in the histology of keratoplasty.** Arch. Soc. oftal. hispano-am. **8**:710-726, July, 1948.

The objective of this laboratory investigation was to demonstrate histologically the biological process initiated by keratoplasty. The eyes were enucleated 25, 30, 35, 60, 80, and 90 days after the transplantations. Immediately after the enucleation the cornea was excised and fixed in formalin. Tangential sections were made to study the innervation, and transverse sections to show the histologic continuity between the transplant and the host. Photomicrographs show that the reparative process has two phases, one of new formation of tissue, and one of differentiation. During the first phase the defect is filled in by more or less undifferentiated tissue; in the second phase this tissue becomes differentiated and functionally active. The histologic picture indicates that for the first few post-

operative days the transplant is bathed in plasma from the interstitial spaces of the corneal tissue of the host. The coagulated plasma and the fibrin serve as cement for the union between the transplant and its bed and provide a passage for the nutritive fluids and nerves. The transverse and tangential sections show an abundance of leucocytes at the margin of the transplant; they are probably transformed histiocytes, or perhaps they are attracted to this site through the chemotactic action of Menkin's leucotaxin on isolated and undifferentiated nuclei which float in the interstitial plasma. It is shown that the penetration of nerve fibers into the transplant begins in the fourth week after the transplantation. The nutrition of the transplant, its trophic innervation and its sensitivity are established within the first few postoperative days. The structure and the function of the various layers of the transplant do not develop until the ninetieth day after the operation. The transplant becomes an integral part of the receptor cornea, and is not eliminated or replaced by other tissue. Ray K. Daily.

Rizk, Kamel. **Treatment of severe infected corneal ulcers by subconjunctival injections of penicillin twice daily without hospitalization, with short review of other methods.** Brit. J. Ophth. **32**:497-504, Aug., 1948.

The author describes a method of subconjunctival injections of penicillin in cases of severe infected corneal ulcers. The treatment has proved unusually successful in comparison with other methods of therapy. One case is reported in detail, and the results of treatment of 26 patients are submitted.

Orwyn H. Ellis.

Sautter, Hans. **Histological findings in a spotty dystrophy of the cornea, obtained by keratoplasty.** Klin. Monatsbl. f. Augenh. **110**:154-159. March-April, 1944.

While some authors believe that Groenow's familial nodular degeneration of the cornea is one disease which may change in type, Bücklers differentiates two distinct forms; the spotty and the crumbly form, strictly confined to the individual and even to a family. The author could examine one case of spotty degeneration clinically and histologically.

After keratoplasty the graft remained clear. Histologic examination of the trephined piece revealed an epithelium that was thinned in places to one to two layers with vacuoles partly detached and prominent over the spots. The foci lie mostly in, partly in front of, Bowman's membrane and partly behind. There was degeneration and scar formation in Bowman's membrane and in the superficial layers of the stroma. There were large mononuclear cells and fine granular disintegration of the cells and lamellar degeneration in many parts of the rest of the parenchyma but no hyaline degeneration. George Brown.

Sherman, A. R. **Treatment of superficial corneal injuries.** Am. J. Ophth. **31**:1467-1472, Nov., 1948. (2 figures, 3 references.)

Stern, H. J., and Landau, J. **Eczematous keratitis and ariboflavinosis.** Am. J. Ophth. **31**:1619-1623, Dec., 1948. (6 figures, 20 references.)

Torres Estrada, Antonio. **Epidemic keratoconjunctivitis. Treatment with streptomycin.** Bol. d. Hosp. oftal. de Ntra. Sra. de la Luz **4**:6-15, Jan.-Feb., 1948.

A generalized epidemic of the disorder appeared in Mexico in the spring of 1947, characterized in a number of cases by punctate keratitis, swelling of the preauricular nodes, and resistance to usual treatments for conjunctivitis. Streptomy-

cin gave surprisingly satisfactory results. The dose varied from 0.8 to 6.0 grams daily. Thirty-five patients were treated. Cases in which the disease was well established took eight or ten days, while the group of patients whose treatment began on the first or second day were cured in three or four days, sometimes with two grams of the drug. W. H. Crisp.

Walker, V. B. **Allergic conditions of the eye: 1. Keratitis rosacea.** Brit. J. Ophth. **32**:759-764, Oct., 1948.

From a survey of 76 cases the author finds that allergy plays a fundamental part in the syndrome of keratitis rosacea. Specific allergens were found in 70 percent. In this group specific desensitization was carried out, and the other patients received histamine. Among those who received histamine, recurrences in two years were almost twice as frequent as in patients in whom the specific desensitization was completed. After desensitization 70 percent of patients remained symptom-free for at least two years.
Orwyn H. Ellis.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Admantiadis, B. **A case of toxic iritis due to absorption of a cataract (phacogenetic iritis).** Klin. Monatsbl. f. Augenh. **110**:234-235, March-April, 1944.

Iritis and moderate hypertension occurred in a 75-year-old patient with Morgagnian cataract. There were many cholesterol crystals in the aqueous and lens and one week later hyphemia, filling half of the chamber. Under conservative treatment with miotics the blood and gradually the fluid part of the cataract were absorbed. The nucleus slipped down to the bottom of the capsule. Nine months later the eye was quiet, all the cholesterol crystals were gone, except a few on the inside of the capsule. Above the nucleus only the capsule was left and the corrected vision was 0.15. A negative physical examination and the fact that with the complete absorption of the lens masses the iritis subsided, confirm the assumption that the iritis was due to irritation by the changed protein of the lens.
George Brown.

Alvarez Alvarez, Abundio. **Iritis and iridocyclitis caused by dental sepsis.** Arch. Soc. oftal. hispano-am. **8**:673-687, July, 1948.

The literature on focal infection in ocular diseases is reviewed, with special reference to the pathogenesis of the process. Two cases of recurrent corneal ulcers cured by the extraction of infected teeth, followed by autovaccine therapy, are reported in detail. Because the vaccine therapy appeared to be the important factor in the cure of the ulcers the author concludes that the disease resulted from a sensitization of the cornea to the nonhemolytic streptococcus isolated from the granulomas on the roots of the extracted teeth. A case of severe iridocyclitis which was getting worse on conventional therapy and which responded promptly to the extraction of an infected tooth is reported as an example of a hematogenous attack on the uvea by the toxins from the infected focus. Ray K. Daily.

Báthori, Zoltán. **Operation for persistent pupillary membrane. Notes on a case.** Brit. J. Ophth. **32**:505-07, Aug., 1948.

When a persistent pupillary membrane is not adherent to the lens capsule, it may be severed by pulling the filaments into the operative wound with a small iris hook. Optical iridectomy is indicated if the membrane is adherent to the lens capsule. Orwyn H. Ellis.

Björk, A. **A contribution to the etiology of choroiditis, with special reference**

to pulmonary changes. Acta ophth. **26**:285-303, 1948.

The object of this study was to demonstrate the relation of choroiditis to pulmonary tuberculosis. The material comprises 116 case histories of hospitalized patients with choroiditis and roentgenograms of the lungs. Of these, 4 were diagnosed as diffuse choroiditis, 26 disseminated, 46 exudative superficial circumscribed, and 40 deep circumscribed; of the latter 10 cases were definitely of the juxtapapillaris type. Positive Wassermann reactions were found in two cases, but only one case could be diagnosed as luetic. The sedimentation rate was normal or but slightly raised. The pulmonary findings failed to reveal definite tuberculosis in this group of patients. Healed lesions, as shown by X rays, were not found with greater frequency in this group than in the control material, which consisted of X ray data on 388 industrial employees. Ray K. Daily.

Bonnet, P., and Jambon-Genet, M. **Metastatic cancer of the choroid.** Arch. d'opht. **8**:465-494, 1948.

The authors state that metastatic cancer of the choroid is not rare, although the literature contains only a small number of observations. They conclude that the origin of the primary tumor is almost always the breast and that metastatic cancer is therefore much more frequent in women. Cancer of the digestive tract and cancer of the lungs or bronchi each produce about 10 percent of cases. Rare cases are produced from tumors of the thyroid, prostate, ovaries, and adrenal glands. The metastases may be observed whether or not the cancer has been operated upon or irradiated postoperatively. It can appear 10 to 15 years after the operation. The choroidal lesion is often the first evidence of general metastasis. The seat of election of the embolic tumors is ordinarily the posterior pole of the globe supplied by the short posterior ciliary arteries. The metastasis occurs extremely rarely in the ciliary body or even on the iris. The tumor tends to infiltrate the choroid beneath the lamina vitrea and the retina is rarely invaded but is often raised and finally detached. The histologic type of the metastatic tumor is often identical with that of the primary cancer. The choroidal metastases are often bilateral; although the common figure for bilateral involvement is 20 percent, the authors consider the true figure to be more like 75 percent.

The authors discuss in considerable detail the important points in the clinical diagnosis of the condition, and their discussion is documented by case reports and ophthalmoscopic drawings. They state that the diagnostic key is often given by a careful systematic study of the apparently unaffected eye. They stress the importance of studying the second eye for the presence of tumor before starting an operation in every case of retinal detachment. They point out that in about one-third of cases an early metastasis resembles a focus of choroiditis. They also point out that the metastatic foci may be multiple. Enucleation of the eye may be required when the blind eye has become glaucomatous and painful. Treatment of the systemic disease consists in roentgen therapy. They describe cases which, under the influence of therapy, have been rehabilitated physically and have survived as long as 22 months. They note that exceptionally the choroidal metastasis can shrink and that the retina previously detached can become reattached spontaneously. Phillips Thygeson.

Cardello, G. **Hypertensive allergic iridocyclitis.** Rassegna ital. d'ottal. **17**: 264-270, July-Aug., 1948.

The presence of ocular hypertension as

an allergic manifestation presents a particularly suggestive aspect, since it could be interpreted as an acute edema, similar to many other allergic phenomena of the skin or mucous membranes. Four cases are related of individuals with an acute ocular hypertension, accompanied by exudates on Descemet's membrane, which pursued a rapid but innocuous course. Resolution was spontaneous but there were characteristic periodic manifestations, at times associated with typically allergic symptoms in other organs. In all of these patients there were constitutional evidences of allergy, such as vasomotor respiratory disturbances, urticaria, and abdominal symptoms. The author considers ocular hypertension as secondary and due to an allergic edema of the vitreous, a fact which should be kept in mind in making an etiologic diagnosis.

Eugene M. Blake.

Doucet, P. **Apparatus for the centrifugation of aqueous humor.** Arch. d'opht. **8**:506, 1948.

A method of making centrifuge tubes for the centrifugation of small amounts of fluid is described. A large thermometer tube having a lumen of 2 mm. is cut into fragments 6 cm. in length. The extremities are ground. A tube holder is constructed of nickel in such a manner that the tube rests upon a glass plate which in turn rests upon a rubber base. The tube is filled by means of a long needle introduced into the lumen. The ordinary aqueous punctate consists of about one-half cc. which is sufficient to fill three tubes half full. The centrifugation is made at 1500 revolutions for 10 minutes.

Phillips Thygeson.

Giardini, Aniceto. **Detachment of the choroid secondary to intracapsular cataract extraction.** Arch. di ottal. **52**:1-107, Jan.-Feb., and March-April, 1948.

The literature is carefully reviewed. There is an extensive discussion of detachment of the choroid based on observation of 408 cases of intracapsular cataract extraction. Detachment occurred in 2.9 percent of these cases. The author bases his conception of the pathogenesis on deductions derived from a previous study of 87 cases of cataract extraction by several methods in which the fundi were examined immediately after the surgery. In this group choroidal detachment was evident in 79 percent of the cases.

Francis P. Guida.

Granström, K. O., and Magnusson, J. H. **Eye symptoms in toxoplasmosis. Observations on four cases in childhood.** Acta ophth. **26**:223-227, 1948.

Four serologically verified cases of taxoplasmosis with chronic uveitis and cataract are described. Ray K. Daily.

Kronenberg, Bernard. **The use of immune globulin in the treatment of uveitis.** Am. J. Ophth. **31**:1271-1273, Oct., 1948.

Lartschneider, J. **A contribution to the etiology and treatment of chronic iridocyclitis.** Wien. klin. Wchnschr. **60**:240, April 16, 1948.

This is a report of one patient in whom a severe iridocyclitis in the left eye cleared up promptly after treatment of an infected left upper molar. The tooth, which had had a large amalgam filling for over 20 years, had never been painful, and was by all tests, including X ray, alive, was drained and packed. Nine days later the patient was cured, and remained well for four years. At this time the identical occurrence took place on the right side, and, under identical treatment, was as promptly cured. B. T. Haessler.

Meyran, Jorge. **A case of congenital aniridia.** Bol. d. Hosp. oftal. de Ntra. Sra. de la Luz **4**:17-18, Jan.-Feb., 1948.

Complicating features included peripheral vascular opacities of the cornea, small opacities scattered throughout the lenses, and posterior polar opacity of the left eye. Both eyes were hypertensive and, operation being refused, the already very poor vision grew progressively worse.

W. H. Crisp.

Milner, J. G. **Etiology and treatment of iridocyclitis.** Medical Press **220**:175-178, Sept. 8, 1948.

The author gives a brief and concise review of the subject. He stresses the importance of early and adequate mydriasis. Much time can be saved and complications averted by the early use of a mydriatic by the general practitioner when the patient cannot be seen soon enough by an oculist. To help the family physician in deciding whether a mydriatic is indicated or not the author carefully differentiates iritis from acute conjunctivitis and glaucoma. Francis M. Crage.

Rabadán Fernández, Pedro. **Remains of the pupillary membrane.** Arch. Soc. oftal hispano-am. **8**:827-832, Aug., 1948.

A report of a case, a review of the embryology of the pupillary region and of the theories of pathogenesis of persistent pupillary membrane remains are exhibited without adding anything new.

Ray K. Daily.

Richardson, Shaler. **Diffuse malignant melanoma of the iris. Report of two cases.** Am. J. Ophth. **31**:1223-1231, Oct., 1948. (7 figures, one colored, 22 references.)

Schachter, M., and Ourgaud, A. G. **Three observations of aniridia.** Arch. d'opht. **8**:382-389, 1948.

The authors have studied three cases of aniridia two of which came from a veritable family of aniridics. These two were studied also from the psychologic point of view by the aid of the Rorschach test. The first case occurred in a child of 15 years who had a total bilateral aniridia. There was an associated somatic and sexual retardation. There was slight mental retardation. Etiologically it was possible to eliminate only syphilitic infection and rubella in the mother during pregnancy. The second patient was a woman of 49 years with complete aniridia associated with subcortical and nuclear cataracts and diffuse corneal opacities. The Rorschach test was less than 50 percent normal. The patient had an obesity of the hypothalamic type. There were 12 cases of aniridia in her family, of which one was in her daughter and others in her father and grandfather. The third patient was a daughter of the second, 17 years of age. She showed a mild mental deficiency but her physical development appeared to be normal. The authors review the subject of aniridia, particularly in relation to glaucoma. Glaucomatous phenomena were found in all three of their cases, mild in the first case but more severe in the second and third. They noted the relative efficacy of eserine.

Phillips Thygeson.

Schreck, E. **Sympathetic ophthalmia, its basic phenomena and its routes of expansion.** Arch. f. Ophth. **148**:361-419, 1948.

Forty-two eyes were studied histologically. The specific infiltration of the anatomically preëstablished lymph-spaces of the eyeballs, the optic nerves and the orbits of both sides is regarded as basic to all the microscopically observed phenomena. The infiltrations consist mainly of lymphocytes, epithelioid cells and giant cells. The primarily affected eye shows perforation of the corneosclera. Uveal tissue fills the wound which is said to be the site of entrance of an ectogenous virus. This virus produces a characteristic perivasculitis and perineuritis. Its spreading is limited to the prefixed lymph

spaces. The virus does not show any histolytic qualities like the tubercle bacillus. The development of the sympathetic ophthalmia is favored by the anatomical conditions of the uvea, which is rich in blood vessels and perivascular lymph spaces. The infection spreads via lymph spaces backward to the neighborhood of the optic chiasma. Here the optic nerve of the second eye is affected and the virus enters the various tissues in the reverse order. Ernst Schmerl.

Skydsgaard, Henning. **Diagnosis of choroidal sarcoma.** Acta ophth. **26**:135-152, 1948.

This is an analysis of the tabulated diagnostic difficulties in intraocular tumor. Among the 237 eyes the clinical diagnosis of choroidal sarcoma was histologically verified in 208 cases, and 29 eyes were enucleated under other clinical diagnoses, chiefly that of glaucoma. Another table gives the histologic findings in 21 eyes enucleated with the diagnosis of tumor, in which no tumor was found; of these, 5 had a visual acuity of 6/18, and 3 of 6/6. In 15 of the 21 cases a shadow was found on transillumination. It was found that preëquatorial transillumination is not reliable if the result is negative. Somewhat more reliable are the data obtained by transillumination of the eyeball through the oral cavity; ophthalmoscopy simultaneous with diascleral transillumination may be of value. In difficult cases transillumination from behind and through the pupil is recommended. A diagnostic puncture is fraught with the danger of extrabulbar inoculation. To illustrate the difficulties 23 cases are briefly reported. In the discussion of this subject Sven Larsson pointed out that in doubtful cases, particularly in monocular individuals, an explorative incision preceded by electro-endothermy may be the means of making the diagnosis. (23 photomicrographs.) Ray K. Daily.

Thiel, R. **Progress in tuberculin diagnosis in ophthalmology.** Klin. Monatsbl. f. Augenh. **110**:177-190, March-April, 1944.

On the basis of 267 cases the author comes to the conclusion that two factors are most important for the diagnosis of a tuberculous uveitis. X-ray examination of the chest if thoroughly done, and as a rule only then, always shows evidence of specific change in the positive cases. For the tuberculin test he uses and approves only of the purified tuberculin (PPD), which, because of the absence of impurities excludes misleading nonspecific reactions. In order to avoid a focal reaction the test is started with small doses equivalent to 0.00001 mgm. O.T. The records of four selected patients demonstrate the importance of X ray and of the tuberculin test.

We know little or nothing about the possible connections between the state of allergy, immunity and the course of the disease. George Brown.

Urrets Zavalia, Alberto. **Gonioscopic findings in lepers.** Arch. Soc. oftal. hispano-am. **8**:807-820, Aug., 1948.

The author examined the angle of the anterior chamber with the Goldman gonioscopic lens in 29 lepers. The patients were grouped according to the classification adopted by the Pan-American Conference on leprosy, namely tuberculoid, not characteristic, and lepromatous. No changes were found in the angle in ten patients with the tuberculoid form, in two noncharacteristic cases, and in two with the lepromatous type. The findings of the 15 cases in the lepromatous group with visible iris lesions are described in detail. The changes consisted of miliary nodules, goniosynechia, anterior peripheral synechia, and loss of the mesenchymal layers of iris tissue at the root of the iris. In only one eye, which appeared free of leprous lesions were miliary nodules found in the angle of the anterior

chamber; the fellow eye had lesions in the cornea and iris. Miliary nodules occur with greater frequency in the angle of the anterior chamber than in the ciliary portion of the iris. Ray K. Daily.

9

GLAUCOMA AND OCULAR TENSION

Bailliart, P. **Some reflections on the nature of chronic glaucoma.** (In French.) Rev. brasil. oftal. **6**:191-202, June, 1948.

This is an interesting but generalized discussion of certain aspects of simple glaucoma, especially the type with positive glaucomatous tendency but no or very slight rise of intraocular tension. The author distrusts any tension higher then 22 mm. with the tonometer. He is disposed to think that simple glaucoma rests upon a basis of arteriolar disease, which may be sometimes in the brain centers. He favors the Lagrange operation, and is still prejudiced against incarceration methods. W. H. Crisp.

Barrenechea, S. A. **Opportunity for surgical intervention in glaucoma.** Rev. oto-neuro-oftal. **23**:6-7, Jan.-March., 1948.

Glaucoma is a surgical disease. Only the oculist should hande this condition, especially in patients using miotics or other medical therapy. In advancing, chronic, simple glaucoma one should not recognize any contraindication to intervention except a patient's general condition, marked hypertension, diabetes or coronary disease. Edward Saskin.

Bauer, Eduard. **The importance of prostigmin in the treatment of glaucoma.** Klin. Monatsbl. f. Augenh. **110**:69-73, Jan-Feb., 1944.

In 55 patients prostygmin was used as a substitute for pilocarpine and eserine and it is recommended.

George Brown.

Ellis, O. H. **The etiology, symptomatology, and treatment of juvenile glaucoma.** Am. J. Ophth. **31**:1589-1596, Dec., 1948. (22 references.)

Esente, Ivan. **Furmethide in the treatment of glaucoma.** Giorn. ital. di oftal. **1**:274-277, May-June, 1948.

Furmethide was used in five cases of glaucoma of different types and a preliminary report is issued. Frequent instillations will reduce the pressure in acute and chronic glaucoma in which normal pressure could not be achieved by means of other drugs. The action is temporary and it is well to use pilocarpine once the pressure has been lowered. No synergism has been noted between pilocarpine and furmethide used simultaneously. There is no relationship between the miosis and the lowering of the pressure, the former always precedes the latter in the absence of anatomical defects. The use of furmethide produces hyperemia of the conjunctiva, occasionally slight chemosis, and uveal hyperemia. When first administered it may produce a slight but very transient rise in pressure. Furmethide produces hemicrania that is usually severe, accommodative spasm and occasionally nausea. It does not affect general arterial pressure and has no toxic effect even after prolonged use. With a sufficiently high concentration in the eye or system there is a conspicuous and profuse sweating which marks the beginning of the greatest hypotensive phase. Francis P. Guida.

Focosi, M. **Histologic observations in a case of recent acute glaucoma.** Boll. d'ocul. **27**:209-227, April, 1948.

In an extremely interesting study, Focosi presents the third or fourth histologic description of an eye which had suffered, and recovered from, a short attack of acute glaucoma. The patient, a

man, 44 years old, had his first attack of glaucoma in his left eye one hour after a glaucoma operation was performed on his right eye. Previously, this left eye had normal vision and normal fields, normal intraocular pressure but a slightly shallow anterior chamber while the fellow eye had a very shallow chamber and all signs of acute congestive glaucoma. Miotics were instilled and the tension of the left eye returned to normal before nightfall. For a few days some deep corneal folds were observed in the eye which otherwise remained normal. Five days after this abortive attack the patient died. Histologic examination of the left eye revealed a normal conjunctiva, almost normal corneal epithelium without fluid accumulation between or beneath the cells, normal Bowman's membrane, and normal corneal parenchyma and Descemet's membrane except for a few shallow folds in the deeper strata. The chamber angle and the trabecular spaces were normal on one side of the specimen and on the opposite side a peripheral posterior synechia (Knies-Manfredi) was present. In some places this synechia was formed by a simple contact of iris and corneoscleral tissue, in others, however, these tissues merged without distinct borders. In the sealed areas the trabecular spaces were obliterated and contained some pigment debris and very few cells. Corresponding to the impermeable part of the trabeculum, the canal of Schlemm was narrowed or even completely obliterated. The author mentions expressly that this obstruction was not due primarily to a filling of the canal with any material but to a collapse of its walls as if compressed to form a complete contact. In this area of obstruction the tissue surrounding the canal was infiltrated by small cells and by pigment; the endothelial lining of the canal, however, was normal and the canal was empty where it was patent. Only a relatively small section of the canal contained an amorphous cast, probably of calcium salts. This deposit intruded into the canad from its external wall and consisted of fine granules, arranged in parallel layers. It extended into one of the canal outlets while all others (number not given) were patent. The obliterated canal outlet was surrounded by moderate small-cell infiltration. Iris and ciliary body showed slight edema and small-cell infiltration of very low degree. Deposits of a substance, easily stained with eosin, and probably a protein-rich fluid, were found in some parts of the iris and more widespread in the ciliary body. The vessels of the latter were slightly engorged, particularly the veins; the vessel walls were normal although a few small hemorrhages were found. The epithelial lining of both the iris and the ciliary body were normal. The choroidal vessels were markedly congested; there were no extravasations and no changes nor inflammatory signs in the vessel walls; only a few small calcareous deposits were found in the choroidal stroma, similar to the deposits in the canal and in one of its outlets. The sclera, its nerves, and the vortex veins were normal; some of the latter contained blood but none showed congestion nor pathologic changes of the vessel wall. The retina and the optic nerve were normal except for a slight edema and slight engorgement of the retinal veins which had normal walls. One branch of the central vein contained an amorphous eosinophilic mass similar to the protein-rich deposits in the ciliary body. The optic nerve sheaths were normal.

This case is of particular interest because of the exact correlation of clinical and pathologic examination, because of the extremely short duration of the first glaucomatous attack and the short interval between the attack and the avail-

ability of the specimen; and because of the age of the patient which allowed the exclusion of senile changes. The absence of inflammatory changes confirms the teaching of Elschnig that acute glaucoma is not an inflammatory disease. The absence of pathologic changes in the vortex veins contradicts the assumption of Heerfordt. The absence of pathologic changes in the optic-nerve sheaths lends no support to Gallenga's theory of their etiologic role in glaucoma. The findings of eosinophile masses in iris, ciliary body, and in one branch of the central retinal vein confirms the results reported by Nicolato in 1939. The local correspondence of the collapsed part of the canal of Schlemm with the area of peripheral posterior synechia proves the close functional relationship between the chamber angle and canal. The presence of calcareous masses in the canal and in one of its outlets and the complete blocking of this outlet by this deposit are unique findings. Considering, however, that only one outlet was occluded, the author would not overestimate the etiologic significance of this interesting observation. (8 photomicrographs, references.)

K. W. Ascher.

Focosi, M. **A particular functional relationship between uterine sympathetic innervation and intraocular pressure.** Boll. d'ocul. **27**:324-329, May, 1948.

Relations between the female hormonal phases and intraocular pressure have been reported repeatedly. A new phenomenon has been observed by the author. During sodium pentothal anesthesia, stretching of the uterus or direct digital stimulation of Frankenhauser's ganglion was followed by a sudden, temporary increase of intraocular pressure. A table showing the data obtained on eight patients contains variations ranging from 4 to 10 mm. Hg. All patients were young or middle aged women with normal blood pressure and with normal eyes. In patients operated upon under local anesthesia the intraocular pressure remained normal. Traction on other parts, such as the omentum, did not provoke the increase of pressure. K. W. Ascher.

Foroni, Camillo. **Valve fistulization in glaucoma.** Giorn. ital. di oftal. **1**:135-146, March-April, 1948.

The author has modified the sclerectomy ab externa in order to reduce the number of late intraocular infections from without. The operation, valve sclerectomy, is one in which the strip created by parallel keratome incisions at the limbus is divided in the middle to provide a valve-like action of the two tongues so formed. This will open more or less as the intraocular pressure varies.

Francis P. Guida.

François, J. **Gonioscopy in primary glaucoma.** Ann. d'ocul. **181**:399-409, July, 1948.

The eyes of 32 patients with simple glaucoma were examined gonioscopically and compared with a similar number of normal eyes in persons older than 50 years. Nothing characteristic was observed gonioscopically in the glaucomatous eyes. The iris angle, ciliary body, canal of Schlemm, ring of Schwalbe, scleral trabeculum and goniosynechiae were compared. In nearly all of 14 patients with congestive glaucoma, blockage of the root of the chamber angle was observed. Anterior angle narrowing is secondary to ocular hypertension and is basically due to neurovascular disease in structurally predisposed eyes. Goniosynechiae are the results and not the cause of primary glaucoma. Chas. A. Bahn.

Heath, Parker. **Ocular hypotony.** Tr. Am. Acad. Ophth. pp. 613-621, July-Aug., 1948.

This important but neglected functional symptom is understandingly dis-

cussed clinically, pathologically and etiologically. Hypotony, characterized by a tension of 10 mm. Hg or less, signifies a temporary or permanent alteration of ocular metabolism which sooner or later is associated with visual impairment. In some respects, it is inverted glaucoma. Both diseases may be primary or secondary, and both usually involve not only structural abnormalities of the corneoscleral shell with its filtering mechanism, but also the neurovascular processes which largely determine the quantity and quality of the intraocular fluid. Hyperparasympathetic and hyposympathetic stimulation are among the predisposing factors. Inflammations which reduce the osmotic pressure of the aqueous or increase that of the blood also predispose to hypotonia. It is more frequent in the early stages of physical or chemical corneoscleral or uveal inflammations as a temporary process of adjustment, or later as part of a general degeneration in which sight is eventually lost. Not infrequently in uveitis the initial hypotension becomes a hypertension as the disease progresses, and ultimately hypotension may again occur as the uveal tract finally degenerates. As a surgical complication hypotonia follows imperfect wound closure, excessive surgical drainage, excessive reduction of ciliary secretion, or secondary serious exudative inflammation. Those interested in ophthalmic diagnostics should read this instructive contribution in detail.

Chas. A. Bahn.

Jaffe, N. S. **Sympathetic nervous system and intraocular pressure.** Am. J. Ophth. **31**: 1597-1603, Dec., 1948. (3 tables, 3 graphs, 17 references.)

Kirby, D. B. **Surgery of glaucoma.** Rev. brasil. oftal. **6**:205-216, June 1948.

This is a summary, in Portuguese translation, of a guest lecture by the author, and epitomizes briefly the various surgical procedures available for the treatment of glaucoma, acute or chronic.

W. H. Crisp.

Kreibig, W. **Nevus flammeus of the face, glaucoma and changes of the skeleton.** Klin. Monatsbl. f. Augenh. **110**:208-216, March-April, 1944.

Extensive nevus vasculosus of the left side of the face was seen in a man of 63 years. There was dilatation with aneurysms of the conjunctival vessels of the left eye. Deeper vessels were less dilated. There was total excavation of the disc and the vessels were displaced toward the nasal side. Tension was normal in the right eye, elevated in the left. The left maxillary and frontal sinuses, ethmoidal cells and facial bones were considerably larger than on the right side. The left orbit was smaller. The changes in the skeleton and the glaucoma are probably due to vascular dilatation and hyperemia with increased stimulation to growth. Similar changes were found in another patient but were less marked, presumably because part of the nevus had been destroyed by irradiation in childhood.

Glaucoma with nevus vasculosus may start in the first years of life or it may become manifest later. In some cases there may be angioma of the choroid. The eyes of patients with extensive nevus vasculosus of the face should be regularly checked.

George Brown.

Matteucci, P. **The carotid sinus reflex in primary and in hemorrhagic glaucoma.** Rassegna ital. d'ottal. **17**:237-246, July-Aug., 1948.

It is possible to observe clinically the effects of the carotid sinus reflexes which are easily demonstrated experimentally. These are: acceleration of the heart action with increased blood pressure, and the cardio-inhibitory sign with lowered pressure. By occlusion of the common carotid artery, these signs are almost constant in normal persons but have little significance in pathologic states. The au-

thor records the influence of these reflexes upon the ocular tonus in twenty patients affected with primary chronic or secondary hemorrhagic glaucoma. In subjects with chronic primary glaucoma no spontaneous or provoked signs of the carotid reflexes were seen. In acute glaucoma there was an acceleration of pressure during the performance of the test, but in two cases of hemorrhagic glaucoma secondary to retinal vein thrombosis the tests were strongly positive. It may be that under these conditions the cardioinhibitory reflex arises and the rapid fall of blood pressure occurs when the thrombotic process is inaugurated.

Eugene M. Blake.

Meek, R. E. **The Elliot trephining operation for glaucoma. A procedure to make this operation less difficult and more effective.** Am. J. Ophth. **31**:1232-1240, Oct., 1948. (20 figures, 10 references.)

Möller, H. U. **Excessive myopia and glaucoma.** Acta ophth. **26**:185-193, 1948.

To dissipate the general opinion that glaucoma is rare in high myopes Möller presents a table of 11 cases of glaucoma in myopes. The difficulties in diagnosis are due to the moderate increase in tension, to the difficulties of funduscopy, and to the confusion of myopic fundus changes with glaucomatous changes. It is urged that perimetric examinations should be done on all myopes who complain of declining visual acuity. Ray K. Daily.

Stallard, H. B. **Anterior flap sclerotomy with basal iridencleisis: a preliminary note.** Brit. J. Ophth. **32**:753-759, Oct., 1948.

The author presents a report on the use of a combined operation for glaucoma which includes an anterior flap sclerotomy, a limited cyclodialysis and a basal iridencleisis, leaving the sphincter of the pupil intact. The method is presented in detail and well illustrated with drawings. Postoperative iritis occurred in only one patient in 29, and the pressure was reduced in 28. Orwyn H. Ellis.

Stine, G. T. **The pressor test for glaucoma.** Am. J. Ophth. **31**:1203-1210, Oct., 1948. (1 figure, 4 tables, 10 references.)

Stoutenborough, W. A. **Iridotasis ab externo for relief of glaucoma simplex.** Arch. Ophth. **39**:173-175, Feb., 1948.

The author dissected a conjunctival flap down to the limbus, much as though a sclerocorneal trephine were to be done. A scleral incision is made ab externo with a knife beginning 2 to 2.5 mm. posterior and parallel to the limbus. The knife should be so directed that the globe is entered about 1.5 mm. posterior to the limbus. The incision is enlarged to 6 or 7 mm. in length. The iris is withdrawn and at one edge of the wound a meridional incision is made in it which includes the sphincter. The iris is then torn across and wedged in the opposite end of the wound. This operation is easier to do and has a number of advantages over the sclerocorneal trephine operation. The author has had almost uniformly satisfactory results with this procedure.

John C. Long.

Sugar, H. S. **The provocative tests in the diagnosis of the glaucomas.** Am. J. Ophth. **31**:1193-1202, Oct., 1948. (1 figure, 7 tables, 12 references.)

Sykowski, Peter. **Chronic simple glaucoma and the lability test.** Am. J. Ophth. **31**:1305-1306, Oct., 1948.

Thomassen, T. L. **Tonometry in cases of excessive myopia.** Acta ophth. **26**:305-311, 1948.

In the search for an explanation of the not infrequent finding of a low ocular tension in glaucoma in myopic eyes, Thomassen made a tonometric study of 47 eyes, with from 5 to 16 diopters of

myopia, without any signs of glaucoma. The tabulated data show that the normal pressure in axial myopia is lower than in other eyes. To determine whether these lower readings corresponded to actual low tension or were the result of an error in the conversion graph of the tonometer, two eyes with high myopia were subjected to a manometric and tonometric investigation. This was done immediately preceding their enucleation because of persistent pain caused by retinal detachment. The technic of the study was similar to that used by Schiøtz. A cannula introduced into the anterior chamber was connected with a water manometer; the pressure within the eye was regulated by the manometer and ten tonometric measurements taken for each pressure. The charted data show that the graph for the myopic eye is not identical with that of the normal eye, and that the apparently low pressure in myopic eyes is due to the inapplicability of the normal conversion graph of the Schiøtz tonometer to myopic eyes. A conversion graph for myopic eyes is suggested. Ray K. Daily.

Torres Estrada, Antonio (with collaborators Icaza, Graue Jr., Agundis, and Reyes). **Alterations of ocular tonus in relation to the general condition in myopic children or to other refractive changes.** Bol. d. Hosp. oftal. de Ntra. Sra. de la Luz **3**:313-327 (in Spanish), 328-339 (in English), Nov., 1947.

From clinical observations here reviewed the authors derive the following conclusions. Incipient myopia is accompanied in at least a third of the cases by more or less pronounced ocular hypertension, evidently related to the general condition of the patient. From this syndrome develop myopia and keratoconus in infancy and adolescence, sclerocorneal ectasias in all periods of life, and glaucoma in adult life. Prevention and treatment of myopia should be aimed toward correcting the general causes so far as they can be found and to control the ocular hypertension. W. H. Crisp.

Trantas, A. **Gonioscopy.** Ann. d'ocul. **181**:385-398, July, 1948.

Some 50 years ago the author apparently discovered and clinically used the basic principles of gonioscopy which are mechanical or optical displacement of the chamber angle, focal or diffuse illumination and magnification, monocular or binocular. The first principle was accomplished by mechanical pressure on the limbus through the lid. Magnification was obtained through strong convex ophthalmoscopic lenses. This crude method still has merit. Improvements are contact glasses to optically displace and magnify the field, binocular magnifying devices, and illuminating devices. The author compares the merits of the Koeppe, Goldman and Troncoso contact glasses and prefers the first because of its increased magnification and field. Some of the differences reported in the literature are apparently explained by the use of different contact glasses.

In both the ophthalmoscopic and biomicroscopic methods of gonioscopy, focal and diffuse illumination may be used. In diaphanoscopic gonioscopy diffuse illumination is employed with scleral finger pressure to displace the angle. Contact glass pressure mechanically alters the vascularity of the area of Schlemm's Canal sufficiently to change its diagnostic value. Invisibility of the angle does not necessarily mean impermeability. Goniosynechiae are the result of glaucoma, and not its cause.

Pigment dispersion and deposit are so frequent in the nonglaucomatous eyes of comparable age and refraction that they have little diagnostic significance. The most important gonioscopic characteristic of primary, chronic glaucoma is invisibility of the canal of Schlemm, an area which the author terms "the red circle."

Chas. A. Bahn.

10

CRYSTALLINE LENS

Blodi, F. **Syndermatotic cataract associated with spring prurigo.** Acta ophth. **26**:379-384, 1948.

A woman, 28 years old, with a weeping eczema of the exposed parts of the body for four years, developed a blur over the left eye. The eczema cleared up entirely in the winter and recurred every summe. The dermatologic diagnosis was spring prurigo. The right eye was entirely normal. The left lens was opaque and somewhat intumescent. There was a thin, dense, shield-like, axial, subcapsular opacity, which was sharply demarcated from the rest of the opaque lens. The lens was extracted, there were no fundus changes and corrected vision was 6/8. The cause of the dermatitis and the cataract is assumed to be a photosensitive substance circulating in the blood, which in the presence of light affects the skin and the lens. Reference is made to the investigations on photosensitive substances in dermatology and to Howell's investigations in which rats sensitized to porphyrin developed cataracts on exposure to light. (2 figures.) Ray K. Daily.

Broendstrup, Poul. **The power of projection in senile cataract.** Acta Ophth. **26**:337-350, 1948.

The literature on the projection of light as a test of retinal function is discussed, with special reference to its applicability in the prognosis of cataract extraction. A positive result, correct projection, is a reliable indication of the function of the retinal periphery. Absent or defective projection on the other hand has no conclusive implications. Some patients with dense cataracts who were in doubt about the direction of incidence from the nasal side, or may have had no projection on that side at all, were found on postoperative examination without any defects in central or peripheral function. There thus arises the question of a physiologic temporal retinal insufficiency, and this investigation is applied towards clarifying this problem. It is possible that there is a primary developmental dominance of the nasal parts of the retina, and it is pointed out that phylogenetically the optic nerve fibers crossing in the chiasm are the oldest. The author's investigation consisted of the preoperative examinations of light projection of 64 patients with dense cataracts. After operation 28 patients had normal projection, 25 had normal temporal projection but were uncertain in identifying the projection from the nasal side, and 11 could not identify the nasal incidence of light and always projected it temporally or saw it directly in front. Postoperatively, the retinal function in all these patients was found normal. An analysis of the cases shows that the poor projection was found in patients with the most advanced cataracts, and that the greatest number of mature and hypermature cataracts is found among patients with poor projection. The nasally defective power of projection is fairly frequent in patients with dense senile cataract and must be regarded as physiological, and poor light projection is not necessarily indicative of a poor postoperative prognosis.

Ray K. Daily.

Byrnes, V. A. **Treatment of delayed postoperative formation of the anterior chamber.** Am. J. Ophth. **31**:1262-1270, Oct., 1948. (1 table, 3 figures, 22 references.)

Dérer, J. **Cataract operation in the aniridic eye.** Bratislavské Lekárske Listy **28**:618-621, 1948.

The case of congenital total aniridia of both eyes, in a patient of twenty years,

was complicated by partial perinuclear cataract, ectopia lentis, moderate bilateral ptosis, and glaucoma of the left eye. A hereditary factor could not be discovered. Linear extraction was performed after preliminary discission. Recovery was smooth. Lens substance left in the anterior chamber was slowly but completely absorbed, with corrected vision of 6/12 for each eye. The hypertension of the left eye proved controllable with eserine and pilocarpine. (References.)

W. H. Crisp.

Duverger, C., and Bregeat, P. **Dislocations of the crystalline lens.** Arch. d'opht. 8:360-371, 1948.

The authors describe the case of a 14-year-old girl with dislocated lenses and arachnodactyly who had an acute glaucoma of one month's duration in the left eye. At operation the lens was removed with but slight vitreous loss, but the anterior chamber became filled with blood and the hyphema persisted over a period of three weeks. The eye eventually became atrophic and was eviscerated.

The removal of the dislocated lens in the right eye was later required because of a drop in vision to less than 1/1. An attack of acute glaucoma followed the use of eserine which had been employed to push the lens, already two-thirds dislocated, through the pupil into the anterior chamber. At operation the lens was removed without loss of vitreous. A hyphemia persisted for 15 days but a final vision of 3/10 for distance and 7/10 for near resulted.

The authors conclude that extraction of a lens in the anterior chamber is a matter of extreme urgency and they caution against the use of miotics in such cases.

Phillips Thygeson.

Ehrlich, L. H. **Spontaneous absorption of congenital cataract following maternal rubella.** Arch. of Ophth. 39: 205-209, Feb., 1948.

A hitherto unreported development in congenital cataract following maternal rubella is its spontaneous absorption, leaving only a membrane in its wake. Such an absorption has rarely been seen in congenital cataracts of presumably other origins. A case in which this process occurred is described. When the child was examined shortly after birth dense white cataracts were observed. Ten months later the cataracts were thinner and a red fundus reflex could be obtained. Discissions done at the age of one year demonstrated the presence of thin membranous cataracts with no lens substance. Four other cases in which this process may have taken place, in three of which the mother had rubella during the early part of pregnancy, are cited.

John C. Long.

Freusberg, O. **Clinical and experimental observations of so called lentoids in human and animal eyes.** Klin. Monatsbl. f. Augenh. 110:199-208, March-April, 1944.

Three eyes are described in which free lentoids appeared on the iris after cataract operation. The lentoids were round, transparent, up to ten in number, 0.1 to 0.5 mm. in diameter and not connected with the secondary cataract. Two cases were in children, four and six years old, with congenital cataract. The lentoids were found four and seven years after repeated operations. In the third patient, 24 years old, with questionable traumatic cataract they appeared after three years. All the other known cases, published before, occurred in young patients, mostly children, with congenital cataract. There seems little doubt that the lentoids are the result of proliferation of lens epithelium, displaced during the operation. They were seen most frequently on the iris, occasionally on the postcorneal surface and once in

the vitreous. A lentoid implanted into a culture medium according to Kirby did not grow and died after six weeks. Attempts to culture human lens tissue had the same result. Cultures of the lens epithelium of 5-day-old chicken embryos, showed epithelial growth.

George Brown.

Hilding, A. C. **Peripheral iridectomy in cataract surgery.** Am. J. Ophth. **31**:1628-1629, Dec., 1948.

Hørven, Eivind. **The frequency of senile exfoliation of the anterior surface of the lens in inflammatory glaucoma.** Acta ophth. **26**:231-235, 1948.

The material for this study consists of 50 eyes operated on for inflammatory glaucoma. No exfoliation of the lens capsule was found. The literature is reviewed. Ray K. Daily.

Huggert, A. **The connection between the position of and the time of formation of zonular lenticular opacities, estimated from the simultaneously occurring enamel hypoplasia.** Acta ophth. **26**:7-18, 1948.

In an investigation to determine the time of the development of the lenticular layers which form the different zones of optical discontinuity, the author examined with the slitlamp and photographed 17 zonular cataracts, measured their size with an eyepiece micrometer, noted their position in the lens in relation to the zones of discontinuity, and correlated the data with the probable time of establishment of a simultaneously occurring hypoplasia of the dental enamel. He secured the coöperation of a dentist, who examined the patients for dental hypoplasia. The teeth were X rayed to obtain an objective record of the position of the defect. The tabulated data show that the lenticular layer of the outer embryonic nuclear zone is established at the time of birth, and the layer within the innermost part of the adult nucleus probably develops between one and two years of age. (5 figures.) Ray K. Daily.

Noyan, Fazil. **Juvenile cataract.** Göz Kliniği **6**:65-74, July-Aug., 1948.

Juvenile cataracts are about 8 percent of all cataracts in Turkey. Their occurrence is ascribed to malaria and paucity of vitamins in the food. The author briefly discusses the biochemistry of the lens and of cataract formation. (21 references.) F. H. Haessler.

Owens, W. C. and Hughes, W. F. **Results of surgical treatment of congenital cataract.** Arch. Ophth. **39**:339-350, March, 1948.

This paper, one of the series of excellent statistical papers that have appeared recently from the Wilmer Institute, should be read by everyone doing cataract surgery. The study included an analysis of the results of operations performed on 231 eyes between January, 1925, and October, 1943.

The authors' conclusions are as follows: "Gross associated ocular defects were present in 129 of 231 eyes with congenital cataract. The visual results in these eyes were significantly poorer than in the eyes without such gross ocular defects. The visual results for the patients on whom the operation was performed before 2½ years of age were poorer than for those operated on after the age of 2½ years. The visual results were essentially the same whether the congenital cataract was complete or incomplete at the time of the operation.

"Linear extraction or discission with subsequent linear extraction produced better visual results than simple discission in the patients with no associated ocular defects who were operated on after 2½ years of age. Operative and

postoperative complications were as frequent in the eyes without associated ocular defects as in the eyes with associated ocular defects. No significant relation was found between the occurrence of complications and the age of the patient or the maturity of the cataract at the time of operation. The type of operation performed had no significant relation to the occurrence of postoperative complications. The number of secondary operations necessary to clear the pupillary space was higher after simple discission than after linear extraction or discission with subsequent linear extraction. Complications occur with essentially the same frequency after the extraction of senile as after extraction of congenital cataract. The poorer visual results after extraction of congenital cataract are attributed to either gross or obscure associated ocular defects." Ralph W. Danielson.

Sédan, J. and Sédan-Bauby, S. **Completion of keratotomy.** Ann. d'ocul. **181**: 414-422, July, 1948.

The evolution of preventive methods to avoid iris injury in cataract incisions from 1786 to the present time is discussed. Among the procedures mentioned are passage of an iris spatula behind the Graefe knife, the use of scissors to enlarge the incision, and the authors' method. In this method the Graefe knife is withdrawn after the initial incision and replaced by a dull-pointed knife with which the incision is completed. The author also compares his method with that of Castroviejo in which straight scissors are used for enlargement of the section. Chas. A. Bahn.

Torres Estrada, Antonio. **A convenient way of separating the lids with threads in the cataract operation.** Bol. d. Hosp. oftal. de Ntra. Sra. de la Luz **4**:29-32, Jan.-Feb., 1948.

Torres Estrada recommends placing in the upper lid two retaining sutures, each penetrating about four millimeters above the upper edge of the tarsus, at the junction of the middle with the outer and inner thirds of the lid respectively, and coming out over the lid margin. The retaining suture for the lower lid is merely placed through the skin. To be secure, all the retaining sutures should be fastened to a firm "operative field" and not merely to a fenestrated compress.

W. H. Crisp.

Vannas, Mauno. **Hernia and prolapse of the vitreous and prolapse of the iris in connection with the cataract operation.** Brit. J. Ophth. **32**:776-782, Oct., 1948.

The author contends that the first vitreous to present in vitreous loss during cataract extraction is the primary vitreous which fills the so-called postlenticular space of Koeppe. After the intervening membrane has ruptured the more solid secondary vitreous appears. The size and contraction of the pupil depend upon the state of the front of the vitreous. The usual iris spatula can be used for replacement of most iris prolapses; however, in severe cases the author recommends a spatula with a sharp needle point or sharp cystitome in order to grasp the anterior or posterior surface of the iris. Orwyn H. Ellis.

11

RETINA AND VITREOUS

Arruga, H. **Detachment of the retina; operative treatment.** Rev. oto-neuro-oftal. **23**:8-9, Jan.-March, 1948.

Most of the good results are achieved after a conscientious examination of the retina is made by direct and indirect ophthalmoscopy. The patient is placed at rest with both eyes covered, the diathermic action is as limited as possible and

the surgery is controlled by repeated ophthalmoscopic examination during the operation. Absolute bed rest postoperatively for several weeks is imperative. If detachment recurs, early rest in bed is again advisable and further surgery may be attempted with great care.

Edward Saskin.

Casari, G. F. **The retinal arterial pressure in retinitis pigmentosa after the use of large doses of vitamin A.** Rassegna ital. d'ottal. **17**:276-284, July-Aug., 1948.

Thirteen cases of pigmentary degeneration of the retina were studied after the administration of 600,000 international units of vitamin A, administered orally in oil. Nine patients showed a diminution of the retinal arterial pressure and four showed no change in either the retinal or general arterial pressure. The phenomena observed were transitory and labile.

Eugene M. Blake.

Dellaporta, A. **Folding of the retina after tension-lowering operations.** Ophthalmologica **116**:51-60, July, 1948.

The author reviews the various diseases or processes which lead to folding of the retina. (See Vogt, Klin. Monatsbl. f. Augenh. **66**:838 1921 and von der Heydt, Am. J. Ophth. **10**:12, 1927.) He then describes in detail the case of a young woman with bilateral chronic glaucoma which was controlled by iridencleises followed by cyclodialyses (one on each eye). Thirteen months after the last operation folding of the retina of the right eye, chiefly in radial direction, was noted and found to be dependent upon the ocular tension which, apparently spontaneously, varied between 15 and 26 mm. Hg (Schiøtz). The folding appeared during the phases of relative hypotony and disappeared during the phases of relative hypertension. The disc did not become edematous. The retinal process was not associated with any visual disturbance. Examination of the eyeground with the slitlamp and Hruby's strong minus lens revealed thickening of the retina and true folding (ridges and valleys) of its inner layers. The author interprets these changes as retinal edema due to the hypotony, analogous to the papilledema due to hypotony.

Peter C. Kronfeld.

Dreisler, K. K. **Unilateral retinitis pigmentosa.** Acta ophth. **26**:385-393, 1948.

Two cases of unilateral retinitis pigmentosa are reported. One occurred in a woman, 63 years old, who had a slowly progressive loss of vision in the left eye for 4 years and the characteristic fundus picture, visual field, and reduced dark adaptation. The other woman, 53 years old, with deafness in one ear, strabismus, and the fundus picture of retinitis pigmentosa in the left eye, discovered the visual impairment in that eye when she was 24 years old, and the eye had gradually become entirely blind. The literature on unilateral retinitis pigmentosa is reviewed, and the 16 cases found in the literature tabulated. Attention is called to recent work on heredity by Gunnar Dahlberg, who demonstrated the occurrence of asymmetrical hereditary factors to which he applies the term "genotypical asymmetry." The author regards unilateral retinitis pigmentosa as a rare form of genotypical asymmetry.

Ray K. Daily.

Fernandez, R. F. **The ocular fundus in general diseases.** Bol. Asoc. med. de Puerto Rico **40**:144-148, June, 1948.

The author describes the ophthalmoscopic changes in the fundi in arteriosclerosis, essential hypertension, diabetes mellitus, lues, toxic neuritis, palillitis and papilledema.

Donald T. Hughson.

Fleischer, Bruno. **Hereditary senile changes of the macula, especially central**

disciform degeneration. Klin. Monatsbl. f. Augenh. **110**:145-149, March-April, 1944.

Three members in one family and two in another had a disciform degeneration of the macula associated in some with circinate changes and confluent colloid bodies, and in one patient with massive deep hemorrhage between macular focus and disc of left eye, which became almost completely absorbed after ten months.

In a second family the mother had a senile atrophy of the macula. In the daughter the macular changes started at the age of 72 years, first circinate degeneration with central atrophy of the pigment and small hemorrhages, later developing disciform degeneration. The author believes that the tendency to macular changes in advanced age is hereditary, leading in some cases to simple senile degeneration, in others to disciform degeneration due to exudation, destruction of Bruch's membrane and organization of the exudate from the choroid. When the simple type is found in one eye and disciform changes in the other they are probably different forms of the same disease.

George Brown.

Haarr, M. **Periphlebitis retinae and its relation to the tuberculous primary infection.** Acta ophth. **26**:41-54, 1948.

Four cases of retinal periphlebitis in persons with primary tuberculosis are reported to illustrate the author's thesis that retinal periphlebitis is not an isolated lesion, but a localized manifestation of a systemic process. These cases show that the nodules, situated mostly at the points where the veins unite, are the first pathologic change, and that the perivascular streaks appear later. Of the seven eyes affected, iridocyclitis was present in four before the fundus changes, and in one eye it developed three months later. Localizations of a perivascular process in the central nervous system, joints, pleura, and kidneys are discussed. (4 illustrations.)

Ray K. Daily.

Handmann, M. **Fat embolism and the eye.** Klin. Monatsbl. f. Augenh. **110**:230-232, March-April, 1944.

Two weeks after fracture of both bones of the lower arm and of two metacarpal bones in a 30-year-old, otherwise healthy patient, fat embolism in a small macular branch of the central retinal artery with edema of the macula was seen. A coexisting hemianopia was ascribed to fat embolism in the brain.

George Brown.

Hibbert, Geoffrey. **A Case of a Grönblad-Strandberg syndrome, with disciform degeneration of the maculae.** Brit. J. Ophth. **32**:478-85, Aug. 1948.

The author presents observations on the development of the syndrome with angioid streaks and pseudoxanthoma of the skin and, in this case, bilateral disciform degeneration of the macula.

Orwyn H. Ellis.

Hsin-Hsiang, Chi. **Retinochoroiditis radiata.** Am. J. Ophth. **31**:1485-1487, Nov., 1948. (1 figure.)

Karpe, G., and Wising, P. **Retinal changes with acute reduction of vision as initial symptoms of infectious mononucleosis.** Acta ophth. **26**:19-24, 1948.

As the initial symptom of an infectious mononucleosis a 20-year-old university student developed a sudden loss of visual acuity and a central scotoma in the right eye, which was accounted for by a pronounced swelling in the macula. When the patient recovered, visual acuity was restored and the macular swelling disappeared, leaving an insignificant swelling of the disc, and dark brown pigmented granules scattered through the macular region. The pathogenesis of the macular lesion is discussed. The lesion is ascribed to the infectious mononucleosis because

the later has a certain neurotropism. (3 figures.) Ray K. Daily.

Kirby, D. B. **Surgery of blepharoptosis and of paralysis of elevation.** Rev. brasil. oftal. **6**:3-8, June, 1948.

This, a summary in Portuguese of a guest lecture by the author, is a brief review of the various techniques used for the purposes indicated. W. H. Crisp.

Kjerrumgaard, Erling. **Retinitis pigmentosa with special reference to otologic, neurologic, and endocrine complications.** Acta ophth. **26**:55-65, 1948.

The material for this study comprises 150 case histories of retinitis pigmentosa, gathered from various hospitals. The disease occurs predominantly in men and the greater number of cases is found during the early school years. Complications occurred in 77 percent of the patients of which 28 percent were otologic, 17 percent neuorlogic, and 12 percent endocrine. The complications are usually found in the recessive and most common type of retinitis pigmentosa. The complications are tabulated, and their pathogenesis is discussed in relation to the time of origin in embryonic life of the gene-determined lesions. The association of these lesions is explained by the fact that the first optic anlage is formed on the twenty-third embryonic day; and the first aural anlage on the twenty-first or twenty-second day, as is also the anterior pituitary lobe, where adiposo-genital dystrophy is localized. The diencephalon likewise develops at this stage, which explains the frequency of epilepsy in patients with retinitis pigmentosa. (6 figures.)
Ray K. Daily.

Kornzweig, A. L. **Occlusion of the central retinal artery. A clinicopathologic study.** Am. J. Ophth. **31**:1421-1428, Nov., 1948. (7 figures, 8 references.)

Lawrence, R. D. **Acute retinopathy without hyperpiesis in diabetic pregnancy.** Brit. J. Ophth. **32**:461-65, Aug., 1948.

The author presents two similar cases of acute retinopathy complicating pregnancy in controlled diabetics in which every test of blood, urine and blood pressure for toxemia was normal. Vomiting was present. Vision improved after delivery by Caesarean section in each case and the eye grounds returned entirely to normal. Orwyn H. Ellis.

MacMillan, J. A. **Histology of the retina in a case of Tay-Sachs's disease.** Am. J. Ophth. **31**:1567-1572, Dec., 1948. (1 table, 3 figures, 12 references.)

Meves, Harald. **The pathology of the vascular changes of the eye in benign and malignant nephrosclerosis.** Arch. f. Ophth. **148**:287-317, 1948.

The blood vessels of the choroid and the retina of the eyes of two young and four old normal persons were studied in comparison with those of six subjects with benign and six with malignant nephrosclerosis. The normal arteries of the choroid showed well developed internal elastic membranes just beneath the endothelium, like the arteries elsewhere in the body. The internal elastic membrane of the central retinal artery, however, was found to split into a number of thin layers throughout the whole thickness of the vascular wall. With benign nephrosclerosis hyalinzation of the choroidal vessels and hyperplasia of the elastic membrane occurred. The retinal vessels showed no changes with the exception of some elastic tissue hyperplasia in their papillary sections. In addition to these changes malignant nephrosclerosis produced choroidal endarteritis obliterans and necroses. The retinal vessels were

much less affected. Endarteritis obliterans occurred in late stages only, necroses were always absent. It is the conclusion of the author that the production of a retinal endarteritis obliterans requires the undisturbed access of circulating blood under an increased pressure. A comparison of the anatomical changes of the retinal vessels with those of the brain and the kidneys does not seem to be justified.

Ernst Schmerl.

Morten, Anker. **Familial occurrence of glioma of the retina.** Acta ophth. **26**:241-245, 1948.

Two families with hereditary glioma are reported, the mother and two children in one family, and a father and daughter in the other. The literature on heredity and glioma is reviewed. Glioma of the retina that occurs in the second generation tends to become more malignant, and the incidence of bilateral cases is greater in the second generation.

Ray K. Daily.

Owens, W. C., and Owens, E. U. **Retrolental fibroplasia in premature infants.** Tr. Am. Acad. Ophth. pp. 18-41, Sept.-Oct. 1948.

Examinations were made of 214 children whose birth weight was 2,000 gm. or less. None of them had retrolental fibroplasia at birth. One hundred and eleven of these children were followed for six months or more. Five cases of retrolental fibroplasia developed in this group. The incidence of retrolental fibroplasia was 1.3 percent in the group weighing from 1,360 to 2,000 gm. at birth, and 12.1 percent weighed less than 1,360. The development of retrolental fibroplasia was followed in nine premature infants. Retrolental fibroplasia developed in these infants between two and five months of age. All visible remains of the hyaloid system had disappeared before the onset of the disease. In these infants the initially normal fundus picture was replaced by an angiomatous dilatation of the retinal vessels, followed by massive retinal exudation, retinal detachment, and the formation of a retrolental membrane. The retrolental fibroplasia occurring in premature infants is not the result of persistence of the hyaloid system.

From this contribution it becomes clear that there are several different conditions which have but little in common except the name retrolental fibroplasia. In some cases the hyaloid system is involved; in others, it is not. Some begin before birth, others do not and some are associated with other congenital degenerative stigmata such as skin hemangiomas. Chas. A. Bahn.

Rosengren, Bengt. **The value of anticoagulants in the treatment of retinal thrombosis.** Acta ophth. **26**:275-279, 1948.

The literature is reviewed and the author's own material analyzed. Heparin was tried in thirty cases; the average duration of the treatment was ten days, with two injections of 250 mgm. daily. The visual acuity was taken as the criterion of the effectiveness of the therapy. The result was an improvement of visual acuity of 0.24 to 0.38 during treatment, with a subsequent fall; there was but little change in the ophthalmoscopic picture, although in a few cases one had the impression of decreased edema and a partial resorbtion of the hemorrhages. Thirty-two patients were treated with dicoumarol, with 24 days as the average duration of treatment; during this period the prothrombin index was held below 60. The mean visual acuity of the patients was 0.22 before treatment and 0.36 afterward and the improvement was maintained one month after the treatment was ended. There was definite improvement also in the fundus picture. It is suggested that the rest in bed incident to this treat-

ment may of itself account for the improvement. It is believed that this method of therapy justifies further trial, particularly since anticoagulants are the only therapeutic agents from which any favorable results could be expected.

Ray K. Daily.

Schulte, Louise. **Retinal detachment and general diseases.** Arch. f. Ophth. **148**: 338-342, 1948.

Of 177 patients, 45 to 70 years old, with retinal detachment, 52 percent had circulatory disturbances, five percent other internal diseases, and 43 percent had no evidence of general diseases at all.

Ernst Schmerl.

Scuderi, G. **Exudative affections of the retina of tuberculous nature. (Part 2)** Rassegna ital. d'ottal. **17**:153-189, May-June, 1948.

The author divides the tuberculous affections of the external layers of the retina into juvenile and senile forms. Two cases of a special form are described which differ from others of the type in ophthalmoscopic appearance, course and final result. These are named "diffuse, benign, external exudative retinitis." Three cases of "central serous retinitis of Masuda," little known in Europe, are also reported. These have been shown by Stenström to be situated in the outer layers of the retina, and Scuderi maintains that they are the result of tuberculous allergy.

The conclusion of these two long articles is that we should classify all exudative processes affecting the outer layers of the retina as senile or juvenile and include the two special forms mentioned above. Eugene M. Blake.

Sie-Boen-Lian. **Spasm of macular arteries.** Arch. Ophth. **39**:267-272, March, 1948.

A case of obstruction of the macular arteries, including the cilioretinal artery, is described. The obstruction is diagnosed as spasm of the ends of the affected vessels, probably of allergic origin. The allergic state is thought to be due to the tubercle bacillus. Ralph W. Danielson.

Szinegh, Béla. **Elimination of anergy to tuberculin in tuberculous eye diseases by administration of vitamin B_2.** Klin. Monatsbl. f. Augenh. **110**:190-194, March-April, 1944.

The Tebeprotein test was negative in two cases of tuberculous uveitis but became positive after three hypodermic injections of 1 mg. of vitamin B_2 on alternating days. The blood picture showed an unfavorable reaction before the injection of vitamin. There was increase of polynuclears and decrease of lymphocytes but the picture was more favorable after the tuberculin test had become positive. The author saw the same results after the injection of liver extract.

George Brown.

Weber, Ernst. **Slitlamp microscopic examinations of the anterior limiting layer of the vitreous and its relations to the lens.** Klin. Monatsbl. f. Augenh. **110**:194-198, March-April, 1944.

The author calls the anterior limiting layer of the vitreous body "vitreous lamella" and distinguishes the part in contact with the lens as the lenticular sheet from the part beyond, the free sheet of the lamella. Partial or total detachments of the lens sheet after trauma were described before. The author examined a man, 69 years of age, with bilateral spontaneous detachment of the lenticular sheet from the posterior surface of the lens, and he believes that the condition was a senile change. The structures might be important in intracapsular extraction. The latter is impossible without loss of vitreous

in children in whom vitreous and lens capsule are grown together, but it is feasible in old patients, when lens and vitreous become more or less detached from one another. George Brown.

Weinstein, P. **The pathogenesis of retinitis diabetica.** Orvosok Lapja **19**:614-615, 1948.

Not only such general factors as increased blood pressure, diminished elasticity of the wall of the vessels and dilatation of the capillaries, but especially local factors are responsible for the hemorrhages of the eyeground in diabetes. Hemorrhages of the eyeground occur when dilatation of the retinal capillaries is associated with low ocular tension.

Gyula Lugossy.

12

OPTIC NERVE AND CHIASM

D'Aiutolo, F., and Longhena, L. **Radiopaque fluids by the Proetz displacement method in lesions of the optic nerve.** Riv. oto-neuro-oftal. **22**:335-359, Sept.-Dec., 1947.

In several patients with visual disturbances an improvement of visual function occurred a few days after the introduction of radiopaque liquids into the paranasal sinuses (Proetz displacement). Visual acuity, visual fields and fundus were examine. The Proetz displacement was then systematically tested in 20 patients with optic neuritis, opticochiasmatic arachnoiditis, bilateral chocked disc and optic atrophy. In almost all cases the results were gratifying. In sinusitis the improvement was probably due to the therapeutic action of Proetz displacement, and when sinusitis was not demonstrable the result might be ascribed to nasal or paranasal reflexes or to a liberation of histamine-like substances. (Bibliography.) Melchiore Lombardo.

Dreyer, H. **Etiology and frequency of retrobulbar neuritis.** Klin. Monastbl. f. Augenh. **110**:170-176, March-April, 1944.

One hundred and fifteen cases of retrobulbar neuritis were seen in the years 1935 to 1943. A statistical analysis is made of the probable, though often questionable, etiology. George Brown.

Morano, Massimo. **Three cases of unilateral atrophy of the optic disc after operation on the lacrimal sac.** Riv. oto-neuro-oftal. **22**:379-388, Sept.-Dec., 1947.

The author reports three cases in which sudden unilateral loss of vision and eventual optic atrophy followed a surgical operation on the lacrimal sac. He discusses the possible pathological process that might explain the occurrences, five in number, and concludes that a causal relationship is most probable.

M. Lombardo.

Panzardi, D. and Gastaldi, A. **Experimental investigations concerning the action on the optic nerve of acridinic antimalaria drugs (Italchin).** Boll. d'ocul. **27**:246-255, April, 1948.

Seven dogs received repeated injections of Italchin for a period of 5 to 31 days. The total amount of the drug was between 2 and 6.4 grams. Severe intoxications were produced and in the dogs which had been given large doses ocular signs similar to those in human quinine intoxication were found. Histologic examination of the optic nerves revealed irritative and productive changes; the drug acts chiefly on the axis cylinders and particularly on their neuroplasm. Both the amaurosis and the reversibility of early lesions are explained by these findings. (3 photomicrographs, 11 references.) K. W. Ascher.

Rosen, Emanuel. **Crater-like holes in the optic disc.** Brit. J. Ophth. **32**:465-78, Aug., 1948.

Seven cases of crater-like holes in the optic disc are reported. This is most often present temporally and below, and never extends beyond the edge of the disc. In several cases vessels were present within the pits. The condition is a congenital one with stationary quadrant defects in the visual fields. Orwyn H. Ellis.

Schreck, Eugen. **Meningioma of the optic nerve in contrast to glioma.** Klin. Monatsbl. f. Augenh. **110**:164-169, March-April, 1944.

Observations of two patients with tumor of the optic nerve are described in detail and made the basis of generalization of value in the differential diagnosis of the lesions.

Histologically both tumors were neuroepithelial and originated in the optic nerve. Meningioma, used by Cushing, is the most appropriate among the many names suggested by different authors for this type. The presence of isolated nests of neuroepithelial cells within the dural sheath in the author's cases supports the opinion that these tumors have their origin in displaced cells. Meningioma and glioma can frequently be differentiated clinically and certainly pathologically. Glioma usually is seen in young women and produces straight proptosis without lateral displacement of the bulbus or involvement of the muscles with considerable early loss of vision with papilledema or postneuritic atrophy. There is little tendency to grow after incomplete removal. In meningioma there is proptosis with lateral displacement, late impairment of vision, involvement of the muscles, temporal pallor or simple atrophy. After incomplete removal there is a strong tendency to recur with invasion of the cranial cavity. Occasionally tumor tissue is visible on the disc or in the retina. It is usually seen in women over 20 years of age. Anatomically glioma is a smooth tumor. It leaves the dura intact and the optic nerve close to the bulbus usually is not involved. Meningioma is a tuberous growth that penetrates the dura and proliferates in the orbit. The differential diagnosis is practically important because the meningioma requires a most radical operation whereas in glioma incomplete removal is sufficient. George Brown.

Tissington Tatlow, W. F. **The prognosis of retrobulbar neuritis.** Brit. J. Ophth. **32**:488-497, Aug., 1948.

The author reviews the literature on retrobulbar neuritis. In a series of patients examined many years after the first visit, he concludes that the prognosis for vision was excellent. The presence of abnormal neurologic findings at the onset of the retrobulbar neuritis does not necessarily mean a bad prognosis, but the progression of further demyelinization can not be foretold. Orwyn H. Ellis.

Wen-Bin, Lo. **Etiology and therapy of acute retrobulbar neuritis.** Am. J. Ophth. **31**:1309-1311, Oct., 1948.

Wium, Erling. **Hereditary optic atrophy with excavation of the papilla.** Acta ophth. **26**:195-211, 1948.

A review of the literature, and a report of five cases in one family in two generations, three in males and two in females are presented. The patients had deep excavations of the papilla without increased ocular tension. An interesting feature was the deteriorating effect of pregnancy in the two women. Ray K. Daily.

13

NEURO-OPHTHALMOLOGY

Bardram, Mogens. **Bitemporal visual field defect in aqueduct stenosis.** Acta ophth. **26**:25-33, 1948.

Two neurosurgical cases of aqueduct

stenosis with papilledema and bitemporal visual field defects are reported. The diagnosis was made by ventriculography. In the presence of such symptoms one must remember the possibility of a lesion in the posterior fossa as well as the local process about the chiasm. (6 figures.)

Ray K. Daily.

Mense, J. S. **Bitemporal hemianopia and apparent fracture of the posterior clinoids resulting from severe cranial injury.** Bull. Los. Angeles Neurol. Soc. **13**: 165-170, Sept., 1948.

The author reviews the literature and presents an unusual case of bitemporal hemianopia with apparent fracture of the posterior clinoids complicating a severe craniocerebral injury. The lesions are best explained by the process of increased horizontal diameters at the time of injury and traction in the involved structures.

Orwyn H. Ellis.

Morano, M. and Oggioni, G. **The physiopathology of the retinal circulation and its relation to certain endocrine disturbances.** Riv. oto-neuro-oftal. **22**:360-378, Sept.-Dec., 1947.

In ten patients whose eyes were normal or had an eye disease, retinitis pigmentosa, for example, an aseptic meningitis was provoked by the intraspinal injection of two cc. of distilled sterile water or an iodine preparation. Changes were found in the optic disc, the retinal blood vessels and retinal vascular pressure similar to those of serous meningitis described by Di Marzio. (References.)

Melchiore Lombardo.

Simonelli, Mario. **The relationship between retinal venous pressure and intracranial pressure.** Giorn. ital. di oftal. **1**: 185-206, May-June, 1948.

Forty-three patients were examined before and after lumbar puncture. Most presented increased intracranial pressure alone and some papilledema. Records were kept of the retinal venous pressure. There is a definite relationship between the retinal venous pressure and the intracranial pressure, less constant and less marked in patients with papilledema. Diastolic retinal arterial pressure is definitely higher in increased intracranial pressure but does not vary with it as does the retinal venous pressure. When papilledema sets in there is a drop in retinal venous pressure, but more so in the retinal arterial pressure. The increase in retinal venous pressure will persist, but not in values parallel to the increase in intracranial pressure. The constancy and the early onset of the increase in venous pressure emphasizes the fact that this increase is one of the first elements in the establishment of papilledema. Following lumbar puncture there is an immediate and consistent drop in retinal venous pressure, never severe, which slowly disappears in 12 to 24 hours.

Francis P. Guida.

Spaccarelli, G. **Foville-Wilson syndrome and posterior internuclear paralysis.** Boll. d'ocul. **27**:228-245, April, 1948.

The term Foville-Wilson syndrome is proposed for the impairment of laterovergence in disseminated sclerosis. It consists of paresis or paralysis of adduction, preserved convergence, and dissociated monocular nystagmus of the abducted eye. Two patients are described extensively, the response to vestibular stimulation and the appearance or absence of diplopia are discussed and the literature is meticulously reviewed. (2 figures, 4 tables, 31 references.)

K. W. Ascher.

Wallach, E. A. **A case of multiple neurofibromatosis with some unusual features.** Am. J. Ophth. **31**:1487-1489, Nov., 1948. (2 figures, 2 references.)

14

EYEBALL, ORBIT, SINUSES

Callahan, Alston. **Removal of orbital tumor through inferior route with Kuhnt-Szymanowski repair of ectropion.** South. M. J. **41**:790-792, Sept., 1948.

In a woman, aged 68 years, whose left eye had developed proptosis in childhood the gradual increase in proptosis became so extreme that the eyeball was limited in motion and very painful. The patient stated that she had no light perception. The left optic disc and retina were normal. The orbital tumor, which proved to be a hemangioma larger than the eye, was removed through an incision anterior to the infraorbital rim. A Kuhnt-Szymanowski repair was a necessary second-stage procedure for the ectropion of the left eye caused by the long-continued presence of the tumor. A year after surgery, the vision in the left eye was 20/40, and she continued in her firm assertion that before surgery she had no light perception whatever. Preoperative and postoperative photographs and three drawings of the surgical procedure are included. Alston Callahan.

Calmettes, Bimes, and Déodati. **Orbital cyst with apparent anophthalmos.** Arch. d'opht. **8**:372-381, 1948.

The authors state that cases of anophthalmos, either true or apparent, have often been described. More rare, however, are the cases in which the apparent anophthalmos is accompanied by an orbital cyst, formed in reality by the microophthalmic eye. A case is described of a six-year-old girl with an orbital tumor having the volume of a nut, but of soft consistency and involving particularly the lower lid. The conjunctival sac was empty and the upper lid appeared to be normal. The right eye was normal. Radiographs of the orbits showed a small decrease in the size of the orbital cavity on the left side. The cyst was removed under general anesthesia and the cyst contents removed by puncture. The sediment after centrifugation showed a large number of lymphocytes. No bacteria were seen. Chemical examination showed a high serum albumin content. Histologic study showed that the malformation consisted essentially in an arrest of development in the stage of the primary optic vesicle. The cause of the arrest of development seemed to be a chronic inflammation of the vessels accompanying the optic vesicle in its development. All stages of a panvasculitis were seen which seemed to suggest a specific hereditary factor. The vascular involvement was evidenced first by an endothelial disturbance and a lymphoid infiltration of the arterial walls which led to the formation of thick paravascular lymphoid sheaths. An extensive sclerosis closed the vessels and transformed them into fibrous cords. The nutritional disturbances secondary to these vascular lesions probably conditioned not only the arrest of development of the optic vesicle but also its involution.

Phillips Thygeson.

Crawford, W. J. **Friedländer's bacillus infection following perforating wound of orbit. Report of a case treated with streptomycin.** Am. J. Ophth. **31**:1293-1296, Oct., 1948. (4 figures, 16 references.)

Engeset, A., and Torkildsen, A. **On changes of the optic canal in cases of intracranial tumor.** Acta Radiol. **29**:57-64, 1948.

The authors report four cases of intrasellar and parasellar neoplasms presenting destruction of the so-called sphenoid strut. This pathological condition may be found associated with a variety of tumors and with aneurysm. Destruction of the sphenoid strut is independent of the type of the lesion, but is highly significant of its localization.

Cases of enlarged sella turcica showing destruction of the sphenoid strut are usually seen in patients where signs of increased intracranial tension are absent.

Theodore M. Shapira.

Forbes, S. B. **Squamous-cell carcinoma of the orbit.** Am. J. Ophth. **31**:1481-1484, Nov., 1948. (1 figure, 2 references.)

Gardner, W. J. **Unilateral exopthalmos due to cerebellar tumor and orbital defect.** J. Neurosurg. **5**:500-501, Sept., 1948.

The case presented is that of a woman aged 26 years whose main complaints were bilateral blindness, protrusion of the left eyeball, and headaches. Projectile vomiting and mental confusion had recently developed. These symptoms followed an automobile accident 13 months before at which time she suffered a fracture of the left arm, ecchymosis about the left eye, and unconsciousness for 24 hours.

A semicystic mass was removed from the upper inner part of the orbit through a roof dehiscence, the size of a 5 cent piece. The increased intracranial pressure was now thought to be due to a posterior fossa tumor. The operation was followed by temporary reduction in the exophthalmos. Eighteen days after the first operation a large hemangiomatous cyst was removed from the medial portion of the right cerebellar lobe. The intracranial pressure was relieved, the exophthalmos receded completely and the patient became cheerful and mentally alert. Eight months after the operation, the last time she was seen, the patient had complete secondary optic atrophy but no recurrence of orbital or mental symptoms. There were no cerebellar signs.

Francis M. Crage.

Hilding, A. C. **Exophthalmos in newborn due to orbital hemorrhage.** Am. J. Ophth. **31**:1484-1485, Nov., 1948. (3 references.)

Jorio, Sergio. **Conjunctival plastic procedures with homologous transplants prepared from the cadaver.** Giorn. ital. di oftal. **1**:89-203, March-April, 1948.

The author advises the use of homologous transplants prepared from cadavers for the prevention of symblepharon and for the reconstruction of the orbital cavity after exenteration. This is of great value in the treatment of pemphigus to prevent the progress of the disease into the cornea. The conjunctiva is fastened to the previously prepared bed by many fine sutures after the removal of all the scar tissue. The procedure is said to be easier than the use of buccal mucous membrane. The use of amniotic membrane proved to be of little value as the late results were unsatisfactory because of shrinkage and the formation of symblepharon.

Francis P. Guida.

Krause, L. **Pure fibroma of the orbit.** Klin. Monatsbl. f. Augenh. **110**:159-163, March-April, 1944.

In a 39-year-old woman a slowly increasing proptosis of the left eye was noted for eight years. Through an incision along the upper margin of the orbit a firm walnut-sized tumor was removed. Seven months later there was still a proptosis of 13 mm., although the eye was otherwise normal. Histologic examination revealed a benign fibroma with some infiltration and degeneration. The point of origin of the tumor could not be determined.

George Brown.

Miller, H. **Rupture of a non-traumatic carotid aneurism.** Ann. d'ocul. **181**:410-413, July, 1948.

Recent progressive exophthalmus with lid edema was observed in a 70-year-old woman on the right side. Total blepharo-

plasty was successfully performed to prevent corneal ulceration and soon after conjunctival injection and edema developed in the left eye. An osseous erosion was observed radioscopically in the sellar region. The author believes that the pre-existing erosion caused the carotid artery to change its direction. Ultimately, its walls became weakened from sclerosis and hypertension. A leak developed in the cavernous sinus and resulted in a venous stasis which involved first the right eye and later, the left orbit.

Chas. A. Bahn.

Naffziger, Howard. **Our present knowledge of exophthalmos and its surgical treatment.** Ann. West. Med. and Surg. 2:397-401, Sept., 1948.

The author discusses the literature, pathology and clinical signs of bilateral exophthalmos related to thyroid disease. Recent investigations have revealed that sympathetic stimulation in man does not produce protrusion of the eye nor does paralysis produce measurable retraction. The author recommends extensive orbital decompression, and the result of the operation depends upon the presence of fibrotic or edematous changes in the muscles. If edema is present additional fluid may be taken up so that the preoperative balance is reached and the surgical effect nullified. Efforts to reduce the pituitary function by X ray and other therapy have been without value.

Orwyn H. Ellis.

Newell, F. W. **Osteoma involving the orbit.** Am. J. Ophth. 31:1281-1289, Oct., 1948. (4 figures, 18 references.)

Ramsey, G. S., Laws, H. W., Pritchard, J. E., and Elliott, H. **Post-traumatic granuloma of the bony orbit simulating tumor.** Canad. M.A.J. 59:206-211, Sept., 1948.

A discussion of orbital tumors with a listing of the 31 tumors that were classified by W. E. Dandy is given. Two cases are reported of injury in the orbit and a third case of injury to a rib. In all three cases radiologic evidence suggested an osteolytic expanding lesion. In all foreign body giant cells with multiple nuclei were seen which surrounded elliptical crystal clefts, cholesterol crystals, hemosiderin, hematoidin and other hemoblobin pigments. There were many foam cells, among masses of dead bone and dense fibrous tissue. There was always evidence of new bone formation at the periphery. The differential diagnosis is discussed. The author points out that giant cell tumor does not occur in membranous bones. Tuberculosis and syphilis are mentioned in the differential diagnosis. Traumatic granuloma is successfully treated by surgical excision. (17 figures.)

H. C. Weinberg.

Reeves, R. J., Baylin, G. J., and Moran, F. **Roentgenologic consideration of unilateral exophthalmos.** N. Carolina M.J. 9:66-73, Feb., 1948.

The authors present 14 pictures in the discussion of unilateral exophthalmos.

The three most common conditions causing unilateral exophthalmos are trauma, inflammation and neoplasm. Roentgenography is of considerable aid in the diagnosis of tumors within the orbit. In most cases of unilateral exophthalmos, the greatest value of the Roentgen ray is in eliminating extra-orbital conditions as possible causes of exophthalmos. Theodore M. Shapira.

Velhagen, K. **Exophthalmos in the light of new investigations.** Rev. oto-neuro-oftal. 23:51-55. July-Sept., 1948.

True exophthalmos must be differentiated first from any pseudo-proptosis such as uniocular enlargement in certain

cases of high myopia or extraocular motor paralysis. Thyrotoxic proptosis is the common exophthalmic state, and one must differentiate those cases in which endocrinal stimulation is inimical. It must be kept in mind that simple exophthalmos may be caused by basophilic hypophyseal adenomas, which respond to irradiation. This condition is occasionally associated with a hypothyroid or antithyrotropic state. In any given case of exophthalmos the hypophysis as well as the thyroid must be investigated carefully.

Edward Saskin.

15

EYELIDS, LACRIMAL APPARATUS

Castro, Mendes de. **Cancer of the eyelid.** Arq. brasil. de oftal. **11**:90-96, 1948.

This is a short statistical analysis of 56 cases treated with radium at São Paulo, and brief clinical reports of two illustrative cases. The advantage of the radiation, if given sufficiently early, is the absence of disfigurement from scar tissue. The lower lid was the more frequently affected, men and women about equally, and the ages were from 56 to 87 years. W. H. Crisp.

Dejean, C. **Some modifications in technique of the operation of Panas for entropion and trichiasis.** Arch. d'opht. **8**:353-359, 1948.

Dejean states that the operation of Panas, while fundamentally sound, has certain imperfections. He proposes certain modifications which he considers to be valuable. The operation as he performs it consists of four stages, as follows: 1. eversion of the lid, preceded by a small canthotomy if eversion is difficult, 2. horizontal incision of the conjunctiva and the tarsus, 2 mm. below and parallel to the ciliary border from the outer angle to a point 1 mm. from the lacrimal punctum and at each extremity a vertical incision to the lid margin, 3. freeing of the tarsal segment from the overlying conjunctiva, and 4. pivoting and suturing of the tarsal segment. The tarsal segment, pivoted 90°, is attached to the tarsus proper by three U sutures emerging on the newly formed ciliary border. The author states that the correction of the entropion is complete from the first and that a good cosmetic result is always obtained.

Phillips Thygeson.

Engelking, E. **Transplantation of epithelium according to Thiersch for the treatment of cicatricial ectropion of the lids.** Klin. Monatsbl. f. Augenh. **110**:150-154, March-April, 1944.

Fifty cases with superficial cicatricial ectropion after corrosions, burns and lupus were operated on in the last four years.

The transplantation according to Thiersch is indicated in superficial and not in deep scars, and only after the shrinking process has definitely come to an end.

The function of the lid is better than with a pedunculated flap because the latter makes the lid too heavy. The healing tendency of the epithelial graft is better than that of a full-thickness skin flap. The size of the defect is less important than in skin grafting and very large areas can be covered. Poor results may be due to faulty technique, to too early operation, or too deep scars. George Brown.

Fox, S. A. **Some methods of lid repair and reconstruction. VI. Reformation of the inferior fornix.** Am. J. Ophth. **31**: 1441-1442, Nov., 1948. (3 figures.)

Guerry, D., III, and Kendig, L., Jr. **Congenital impatency of the nasolacrimal duct.** Arch. Ophth. **39**:193-204, Feb., 1948.

The term congenital impatency of the nasolacrimal duct should be used instead

of congenital dacryocystitis and congenital dacryostenosis. In a series of 200 consecutive, unselected newborn infants, congenital impatency was found in six percent. In all cases the condition cleared under daily massage of the lacrimal sac and local application of penicillin ointment. In some patients, not included in the series, probing was resorted to after six months of conservative treatment. A Bowman probe was introduced through the superior punctum and canalliculus in ether anesthesia. The bare tip of the probe was identified in the inferior meatus. Cure was affected in all instances.

Injections of iodized oil through the inferior punctum revealed well filled sacs but no radiopaque material in the duct, an observation which was probably not due to a blockage at this level but, rather, to failure of the material to enter the duct. John C. Long.

Hogan, M. J. **Dacryocystorhinostomy.** Tr. Am. Acad. Ophth. pp. 600-612, July-Aug., 1948.

In a series of 49 cases cures are reported in 90 percent. The technique used was essentially that of Toti-Mosher. Indications include closure of the lacrimonasal duct with or without infection, and incomplete surgical removal of the sac, with discharge or fistula. Acute dacryocystitis, permanent obstruction of the lower canaliculus, associated diseases such as syphilis, tuberculosis, tumors of the sac, and active nasal disease are contraindications. This operation is apparently no contraindication to subsequent cataract extraction. In the postoperative care daily irrigation of the lower punctum during the first week is considered important. Incomplete diagnosis, faulty surgical judgment or technique are responsible for most failures. Lipiodol and antibiotics facilitate the handling of more complicated cases. Chas. A. Bahn.

La Rocca, Vito. **Plastic repair of a congenital deformity of the external canthus.** Am. J. Ophth. **31**:1479-1481, Nov., 1948. (4 figures.)

Majoros, Janos. **An operative procedure for cicatricial entropion.** Acta ophth. **26**: 363-371, 1948.

The operation, which the author calls an eversion of the palpebral margin, is advocated on the basis of results in 243 cases. It begins with a tarsotomy by an incision through the conjunctiva and tarsus 2.5 to 3 mm. from the lid margin; the tarsoconjunctival mass is then dissected from the skin. Three sutures unite the cut edges of the tarsus in such a manner that the lid margin is everted, with the lashes directed forward. The final appearance is that of an ectropion. For partial trichiasis the eversion may be performed in the involved area by making vertical incisions through the portion of the tarsus to be everted. For the lower lid the operation has to be supplemented by an excision of an oval piece of skin. (4 figures.) Ray K. Daily.

Mascati, N. T. **A new operation for entropion and trichiasis of the upper eyelids.** Indian M. Gaz. **83**:79-81, Feb., 1948.

This article describes the surgical technique of using a hinged skin flap from the upper lid which is brought down subcutaneously to the gray line and anchored. The wound and the skin of the upper lid are then closed. This procedure is used to correct entropion and trichiasis of the upper lids. Donald T. Hughson.

Morgenstern, D. J. **Chronic tearing cured by reestablishment of normal tear conduction passages.** Arch. of Ophth. **38**: 775-795, Dec., 1947.

Chronic tearing may be caused by slight degrees of facial weakness. Cure may be brought about by tightening the

relaxed lower lid by means of electrocoagulating acupunctures. Abnormalities of the eyelids and means of their correction are described. Treatment of abnormalities of the puncta and canaliculi are discussed. When the canaliculi are blocked by chronic swelling, the tear sac and nasolacrimal duct are usually similarly obstructed. The use of diathermy to remove obstruction in the nasolacrimal duct is described Rechannelization by application of the diathermic current is ideal in congenital dacryostenosis where more conservative measures have failed. Most chronic tearing has an underlying etiologic factor of chronic nasal sinusitis. Close cooperation between the ophthalmologist and the rhinologist is necessary in order to secure the best result for the patient. John C. Long.

Thomson, A. M. W. **Diseases of the lacrymal sac.** Medical Press **220**:93-95, Aug. 4, 1948.

The causes and treatment of obstruction in the lacrimal drainage system in infants and adults are discussed. The author comments on the frequency of lacrimal obstruction in women during the years of the menopause.

Donald T. Hughson.

Wessely, K. **Contribution to the surgery of entropium.** Arch. f. Ophth. **148**: 358-360, 1948.

The middle third of the margin of the lower lid serves as the shorter base line of a rectangular flap. By shortening the flap as much as seems desirable the entropium is corrected in a way comparable to the use of a strip of adhesive tape.

Ernst Schmerl.

Woysitka, N. W. **Congenital atresia of the nasolachrymal duct.** Canad. M.A.J. **59**:357-359, Oct., 1948.

The embryology of the nasolachrymal duct is described and the possible hereditary causes of atresia are listed. In the case reported the lesion was traced back through five generations. Nine of the forty-six members of the family had congenital dacryostenosis. A discussion of the parental characteristics which predispose to this congenital defect follows. (1 figure. 1 table.) H. C. Weinberg.

16

TUMORS

Andersen, S. Ry. **Congenital fibroma of the cornea.** Acta ophth. **26**:331-336, 1948.

A six-months-old infant was found to have a protruding nodule in the center of the right cornea. It was excised, and histologically it was impossible to make a definite distinction between a fibroma and hyperplastic connective tissue. The presence of the nodule at birth, and the absence of evidence of a preëxisting keratitis, justify the diagnosis of true fibroma. An analysis of the cases reported as fibroma of the cornea, reveals only one case, described by Musial, similar to the one being reported. It is believed that the growth develops through a proliferative tendency of the mesoderm, as a developmental anomaly in the substantia propria of the cornea. Ray K. Daily.

Andersen, S. Ry. **Medullo-epitheliomas. Diktyoma and malignant epithelioma of the ciliary body.** Acta ophth. **26**:313-330, 1948.

A case of diktyoma is reported in a 16-year-old girl, in whom the growth was noticed at birth. It grew slowly and steadily, and at the age of 16 years it appeared as a slightly papillomatous, richly vascularized growth occupying about one-third of the area of the iris. The histologic examination of the enucleated eye established the diagnosis of diktyoma, and revealed the invasive nature of the tumor,

which at one point extended into the cornea. There was a greater proliferation of pigment than that formerly described in connection with these tumors, and the similarity of the cells to embryonic retina was absent. The structure of the tumor was therefore a transition between a diktyoma and a malignant epithelioma. The literature of malignant tumors of the ciliary body is reviewed and critically analyzed. Of 16 reported cases of malignant epithelioma, Andersen believes that in nine the diagnosis was incorrect, and he classifies them as malignant melanomas. Of 22 cases of diktyoma found in the literature, three are considered transition forms between this tumor and malignant epithelioma. The occurrence of transition forms is explained by the fact that both tumors arise from the epithelium of the ciliary body. If the tumor develops from cells in a stage of differentiation corresponding to those of the embryonic retina before the sixth fetal week the result is a typical diktyoma—if the tumor develops at a later stage of differentiation, the neoplasm approaches the structure of a malignant epithelioma. (5 figures.)

Ray K. Daily.

Benjamin, B., Cumings, J. N., Goldsmith, A. J. B., and Sorsby, A. **Prognosis in uveal melanoma.** Brit. J. Ophth. **32**: 729-747, Oct., 1948.

A series of 250 consecutive cases of melanoma of the choroid was studied histologically and the mortality analyzed. It was found that mortality is influenced to some extent by cell grade, but more by pigment and reticulin content. The prognosis is favorable when there is slight pigmentation and unfavorable when there are epitheloid cells and low reticulin content. The mortality in a series of 30 cases of melanoma of the ciliary body was somewhat higher than in melanoma of the choroid.

Orwyn H. Ellis.

Givner, I., and Wigderson, H. **Cranial epidermoid with erosion of the roof of the orbit.** Arch. Ophth. **39**:300-304, March, 1948.

Bostroem, in 1897, first used the term epidermoid and pointed out the many opportunities for bits of ectoderm to be pinched off during closure of the neural tube. He stated that when cells destined only for the epidermis are pinched off, they give rise to tumors exhibiting only epidermoid structures. When deeper layers are also included, a dermoid develops, containing hair and skin glands as well. The cranial epidermoid does not infiltrate but merely displaces brain tissue; though the outer layers of the tumor are friable, its growth is so inexorable that it will erode and destroy any unyielding tissue with which it may come in contact, including bone. Cushing, in a series of 2,004 cerebral tumors, found that only 0.6 percent were epidermoids. A case is reported in an 84 year old man.

Ralph W. Danielson.

Jensen, C. D. F., and Haffly, G. N. **An unusual case of progressive melanosis oculi.** Am. J. Ophth. **31**:1476-1479, Nov., 1948. (4 figures, 4 references.)

Olesen, H., and Sjøntoft, F. **Sympathicoblastomas with metastases to the orbit.** Acta ophth. **26**:67-87, 1948.

Two cases of sympathicoblastoma in children 18 months and four years of age respectively are reported. In one case exophthalmos was the initial symptom and in the other it developed late in the disease. The primary tumor was located in the left adrenal in one and in the right lumbar sympathetic trunk in the other. A review of the literature on the genesis, pathology, and symptomatology of these tumors is made. It is important to keep this tumor in mind when evaluating exophthalmos in young children. (4 photomicrographs.)

Ray K. Daily.

17
INJURIES

Binder, D. K. **Ointment absorbed through corneal wound.** Arch. of Ophth. **38**:830-832, Dec., 1947.

A machine operator was struck in the eye with an object which produced a small perforating linear wound just below the center of the cornea. An ophthalmic ointment was instilled into the eye at the first aid station. Later two spherical yellowish globules were found within the anterior chamber. The two globules later coalesced to form one. The globule was lighter than the aqueous fluid and always sought the highest point in the anterior chamber. It was later removed through a keratome incision without incident. After perforating wounds of the cornea one should not use ointment in the eye. John C. Long.

Cati, P. **An uncommon mechanism of entrance into the inner eye of a metallic foreign body.** Boll. d'ocul. **27**:256-265, April, 1948.

Six case reports and five X-ray films are offered to call attention to the injury of the eye by the penetration of wire fragments from a whip. These whips were made by attaching telephone wire to a stick and the injuries were suffered by horsedrivers. Often these injuries are underestimated because of the improbability of a foreign body in an eye struck by a whip. The cornea may show no signs of injury when the wire fragment entered through the sclera. The lens may stay clear, at least for a certain time, but the vitreous body will appear cloudy. Magnet operations are, of course, useless if the wire fragment is of copper or its alloys. Roentgenographic examination should never be omitted in suspicious cases.
K. W. Ascher.

Kuhn, H. S. **The use of hydrosulphosol (sulphydryl) in the treatment of chemical or thermal burns of the eyes.** Indust. Med. **17**:347-350, Sept., 1948.

A study of the effects of a sulfur-bearing chemical substance containing the sulphydryl radical on chemical and thermal burns of 300 eyes is reported. The dilution of 1:20 of the hydrosulphosol concentrate in castor oil is instilled in the conjunctival sac in sufficient amount to fill the latter. Careful handling of the lids, pontocaine anesthesia, and the indicated cycloplegic are necessary prerequisites. For proper healing a pressure bandage is strongly advised. The latter consists of two eye pads held snugly in position by scotch tape. Next a piece of gauze is placed over the pads and a black tie-patch covers the whole dressing. Immobilization is the aim of such a dressing. Seven cases, six of which had corneal complications, are described in brief.

The treatment is said to control pain effectively throughout the convalescence. The time required for complete healing was frequently less than 24 hours. In others it was shorter than that following the use of other methods. Less visual loss was noted and fewer eyes were seen in which flaps were required or contractures developed. Francis M. Crage.

Leoz Ortin, G. **When and how should an eye be enucleated, for fear of sympathetic ophthalmia.** Arch. Soc. of'al. hispano-am. **8**:781-799, Aug., 1948.

Leoz makes a plea for the conservation of eyes after trauma, believing that many are enucleated unnecessarily, because of the fear of sympathetic ophthalmia. When removal of an eyeball becomes imperative, he believes that evisceration should be done in order not to interfere with the development of the face, as occurs after enucleation. Removal of the eyeball is indicated when the eye is completely destroyed by trauma, when it is in a state of painful phthisis with frequent acute exacerbations of inflammation or when it

contains an intraocular foreign body and is away from ophthalmologic observation because the patient lives in a rural community. Ray K. Daily.

Lucic, H. **Intraocular foreign bodies in Naval personnel.** California Med. **69**:114-119, Aug., 1948.

The author reviews the literature and states his indications for using the anterior or posterior route of intraocular foreign body removal. The Comberg method of localization is described, and the advantages of using the Berman Locator indicated. Many eyes with small nonmagnetic particles were left undisturbed, because the foreign bodies were well tolerated. Orwyn H. Ellis.

Middleton, J. M. **Selenium burn of the eye.** Arch. of Ophth. **38**:806-811, Dec., 1947.

Most selenium compounds are vesicants. They are acid in reaction, and their toxic action on tissues is the same as that of any strong acid, producing burns, which are slow to heal. The replacement of the sulfur in keratin by selenium may heighten the otherwise simple trauma of a burn. A case of burning of the eye by selenium dioxide is reported. A mucous membrane graft was made, but, in retrospect, the procedure may have been unnecessary. Intravenous administration of fluids was used to combat a possible toxic level of absorption. It was felt that 2,3-dimercaptopropanol (BAL) therapy may have been the ideal method. Complete recovery from acute symptoms occurred within ten days. John C. Long.

Ricci, G., and Bruna, F. **Professional allergic streptomycin dermatoses.** Boll. d'ocul. **27**:330-341, May, 1948.

Five nurses charged with the administration of streptomycin for a period of one year developed redness, edema, itching and burning on uncovered parts of their skin, particularly the eyelids, and the conjunctivae. Preventive measures and therapy with histamine are discussed. K. W. Ascher.

Santoni, A. **The extraction of intraocular foreign bodies through the sclera.** Boll. d'ocul. **27**:367-382, June, 1948.

In the Naples University Eye Clinic, intraocular foreign bodies usually are localized roentgenologically and extracted through the sclera after diathermy coagulation of the scleral region surrounding the operative area. Twelve operative histories are reported; no traumatic cataract and no retinal detachment were observed. K. W. Ascher.

18

SYSTEMIC DISEASE AND PARASITES

Anderson, C. H. **Laurence-Moon-Biedl syndrome.** Brit. M. J. pp. 517-518, Sept. 11, 1948.

The association of polydactylism, obesity, hypogenitalia, retinitis pigmentosa and mental retardation, with a familial occurrence, is known as the Laurence-Moon-Biedl syndrome, and was described in 1921 by Biedl. Some variants have been described. In the case reported a 45-year-old spinster, had had rudimentary sixth digits which had spontaneously wasted and disappeared in infancy. She was obese, and had retinitis pigmentosa. Mental retardation was not an obvious feature, and amenorrhoea, which is usual in hypogenitalism, was not present. (References). Bennett W. Muir.

Arruda, Jonas de. **Ophthalmology of undernourishment.** Rev. brasil. oftal. **6**: 9-22, June, 1948.

The author tabulates the various types of avitaminosis with their general and local symptoms, and also tests for keratinization. The palpebral, nasal, and labial eczemas, although commonly attributed to ariboflavinosis, underwent

rapid and profound improvement under administration of vitamin A, in daily dosage of 50,000 international units. (References.) W. H. Crisp.

Balcet, C. **Ocular manifestations of malnutrition.** Rassegna ital. d'ottal. **17**:271-275, July-Aug., 1948.

The writer, who was a prisoner of war in a German detention camp, had opportunity to observe at first hand the sufferings of the imprisoned. He describes the condition of these people and especially the lack of sufficient and nourishing food. Among the ocular changes noted were diminution of the power of accommodation, aggravation of myopia, skin lesions of the eyelids, "lymphatic" conjunctivitis and keratitis, paratuberculous lesions of the conjunctiva and cornea, and rheumatic iritis. There were no evidences of night blindness nor of cataracts due to insufficient diet. Retinal hemorrhages due to lack of vitamin C were frequent and three cases of rapid development of glaucoma were seen. Remarkable recovery from the insufficient alimentation was usual within a few weeks.

Eugene M. Blake.

Bauza, J., and Castro, E. de. **Study as to pulmonary and choroidal changes in the acute stage of measles.** Arch. chilenos de oftal. **4**:363-376, Jan.-Feb., 1947.

The author makes reference to an article published by him in 1945, dealing with meningo-encephalitis accompanying measles. The present report has to do with two children (brother and sister) who had fallen ill a week previously with characteristic symptoms of measles. Both had high temperature. The brother ran a normal course and recovered without complications but the sister, aged four years, had general irritability and much headache, and further developed rigidity of the nucha and paralysis first of the left lower and soon after of the left upper extremity. Examination of the cerebrospinal fluid confirmed suspicion of meningeal involvement. There was reason to suspect exposure to an acute tuberculous infection (from a servant with hemoptysis) six months earlier. The encephalitis picture was present four days before appearance of the measles eruption. An area of acute choroiditis was interpreted as tuberculous, and there was a suggestion of peribronchial infiltration. In spite of blood transfusions and penicillin, the girl died on the twenty-fifth day. Autopsy was refused. (References.)

W. H. Crisp.

Beierwaltes, W. H. **Exophthalmos and thiouracil therapy.** Arch. Int. Med. **81**: 364-368, March, 1948.

Twenty-eight patients with thyrotoxicosis and without malignant exophthalmos treated with thiourea derivatives alone had no significant average increase in exophthalmos as measured weekly for an average period of four months. Ten percent of the patients showed a significant increase, as compared with an incidence of 50 to 66 percent reported by other authors after thyroidectomy, and with an incidence of 20 percent after X-ray therapy for thyrotoxicosis. Seven patients with high basal metabolic rates and some evidence of malignant exophthalmos treated with thiourea derivatives alone showed a significant increase in exophthalmos of 1.8 mm. in an average observation period of 5.7 months. Four patients with low metabolic rates and malignant exophthalmos treated with Lugol's solution and desiccated thyroid showed no increase in exophthalmos in a period of 13.5 months. It is important to distinguish between patients with malignant exophthalmos and those without it when evaluating changes in the eyes resulting from medical therapy

for thyrotoxicosis. (1 figure, references.)
Bennett W. Muir.

Braley, A. E. **The relationship between ocular disorders and thyroid dysfunction.** J. Iowa M. Soc. **38**:435-437, Oct., 1948.

The experimental work on exophthalmos by G. K. Smelser is briefly reviewed. The author stresses the fact that exophthalmos may be produced primarily by an increase in the secretion of the anterior pituitary. This can give rise to an exophthalmos which may be present with a normal basal metabolic rate. In an illustrative case the exophthalmos appeared suddenly and was bilateral in a patient whose metabolic rate was a little below average. It receded under administration of 5 grains of thyroid per day. Glaucoma which appeared in both eyes was only moderately controlled by 2 percent pilocarpine.

The ophthalmologist is urged to assist the surgeon in making a differential diagnosis as to whether the exophthalmos is primarily a manifestation of Graves' disease or is due primarily to anterior pituitary dysfunction. In Graves' disease there is a lag of the upper lids with marked spasm of Müller's and Landstrom's muscles which produces the exposure of the upper and lower part of the cornea. The muscle balance is normal and double vision is rare. When exophthalmos is caused by primary dysfunction of the anterior pituitary there is only slight lid lag and very little spasm of Müller's and Landstrom's muscles. There is edema of the bulbar conjunctiva, and muscle imbalance with diplopia are common.

Borderline patients should be given thiouracil or propylthiouracil. If both the muscle imbalance and the exophthalmos increase during the trial the disease should be considered as primary in the anterior pituitary. H. C. Weinberg.

Capolongo, Giuseppe. **A contribution to the study of the etiology of ocular involvement in chickenpox.** Giorn. ital. di oftal. **1**:119-131, March-April, 1948.

The author has seen in patients with chickenpox keratoconjunctival focal lesions which resemble phlyctenular keratoconjunctivitis. He maintains that in the majority of cases the lesion is a manifestation of an allergic response to the chickenpox, but that in patients with an active tuberculosis or scrofula of other parts of the body it represents a modified allergic response to the tuberculosis. He states that suprarenine in 1/1000 solution is the most efficacious form of treatment.
Francis P. Guida.

Drell, M. J. **Ocular manifestations of pregnancy.** West. J. Surg., Obst. and Gynec. **56**:455-458, Aug., 1948.

The author stresses the great importance of ophthalmoscopy in toxemias and other vascular diseases associated with pregnancy. As a prognostic aid ophthalmoscopic findings are usually accurate. The differences between the reversible and the irreversible retinal changes are outlined. The fetus may have insterstitial keratitis, the complications of maternal rubella, and the congenital deformities associated with prematurity.
Orwyn H. Ellis.

Epstein, E. **Intraocular cysticercosis: report of a case.** South African M.J. **22**: 625-626, Oct. 9, 1948.

A 31-year-old European developed a cysticercosis of the vitreous of the right eye. The parasite was observed in indirect ophthalmoscopy. After the diathermy of the sclera an incision was made behind the lateral rectus, the wound edges retracted and the parasite was removed. The technique is described. (1 figure.)
I. E. Gaynon.

Fischer, J. T. **Basedow's hyperophthalmos; its surgical contraindication.** Rev.

oto-neuro-oftal. 23:10-14, Jan.-March, 1948.

The author differentiates between the two usual types of systemically caused exophthalmos. The one is part of true thyrotoxic goiter with exophthalmos and is associated with an increased basal metabolic rate. This exophthalmos is dynamic in nature and is due to hypotony of the recti muscles. The patient is generally improved after thyroidectomy. In Basedow's exophthalmos the protrusion is due to a generalized retrobulbar edema, edematous thickening of the muscles with lymphatic infiltration, edema of the fatty and connective tissues, and an increase in the amount of fat and connective tissue. This is a thyrotropic disease and is due to overactivity of the anterior pituitary body. (To be continued).

Edward Saskin.

Friedmann, Martin. **Thelazia callipaeda, the "oriental eye worm."** The Antiseptic 45:620-626, Sept., 1948.

The first case of infection with Thelazia callipaeda in man in India is reported. Only eight have been published before, six from east Asia and two from California. Thelazia in mammals are frequent. The life cycle of the worm and its intermediate host are unknown, but it is suggested that the latter is an arthropod. The possible ways of infection are discussed and comparisons with other filarial diseases are made.

The worms were discovered in a child who had no complaint whatever except that she had inadvertently rubbed an irritant into her eye. From the lower fornix and outer cornea of the left eye white worms wandered with snake-like movement over the conjunctiva and cornea. The worms are white filarial organisms 20 mm. long. In a blood smear 35 percent of the cells were eosinophiles, although the eosinophilia may have resulted from infestation with other worms. The stools were a veritable museum of worm eggs.

F. H. Haessler.

Ghanem, S. A. **The eyes and frequent headaches.** Arq. brasil. de oftal. 11:40-59, 1948.

Very many cases are briefly cited, with formulas of glasses ordered for relief of severe headaches, particularly of the migrainous type. Results were often disappointing but emphasis is laid on the importance of considering refraction in dealing with such cases.

W. H. Crisp.

Harrington, D. O. **Psychosomatic interrelationships in ophthalmology.** Am. J. Ophth. 31:1241-1251, Oct., 1948. (31 references.)

Lepri, Giuseppe. **Ocular manifestations in the course of acute generalized tuberculosis.** Arch. di ottal. 51:151-211, Oct.-Nov.-Dec., 1947.

The varied ocular manifestations accompanying acute generalized tuberculosis are reviewed. During the treatment of acute tuberculosis with streptomycin or similar treatments (streptomycin-sulfonamid-vitamin A method of Cocchi), a change in the development of the ocular manifestations was noted. The treatment is of greatest value in the miliary lesions of the choroid which almost always accompany the miliary form. The lesions become relatively benign in nature. A somewhat lesser efficacy is demonstrated in the ocular lesions which accompany tuberculous meningitis. In the cases observed there was an alleviation of the symptoms and a prolongation of the course even though the disease ended in death.

Ophthalmoscopically it was evident that the choroidal foci of tuberculosis, even nodules of rather large size, showed a tendency toward scarring with a participation of the choroidal pigment. With-

out histologic examination it is impossible to speak of healing of the lesions.

Francis P. Guida.

Levitt, J. M. **Ocular manifestations in coccidioidomycosis.** Am. J. Ophth. **31**: 1626-1628, Dec., 1948. (4 references.)

Marín Amat, M., and Marín Enciso, M. **Hysterical amaurosis and the role of the ophthalmologist.** Arch. Soc. oftal. hispano-am. **8**:800-807, Aug., 1948.

The authors report a case of hysterical amblyopia in a woman, 23 years of age, with domestic difficulties, and promptly cured with injections of vitamin B. The rapid onset of blindness, negative fundus findings, and normal pupillary reactions suggest the diagnosis. Prudence and tact should be exercised in handling the patient as well as the family. The psychiatrist need be consulted only in exceptional cases, and the ophthalmologist should have sufficient training to deal with the ordinary problem. (Visual fields.)

Ray K. Daily.

Rosen, Emanuel. **A postvaccinial ocular syndrome.** Am. J. Ophth. **31**:1443-1453, Nov., 1948. (21 references.)

Rosenberg, S. W. **Stevens-Johnson syndrome.** Wisconsin M. J. **47**:766-768, Aug., 1948.

The author reviews the characteristic signs and symptoms and mentions the conditions from which the syndrome must be differentiated. From an analysis of cases previously reported, although there is no specific treatment, sulfonamides alone or together with penicillin seem to be beneficial. The case reported is unusual in that two major attacks and four minor attacks were observed in a young white man in the course of seven years.

Donald T. Hughson.

Rubino, A., and Pereyra, L. **Earliest ophthalmic signs in one hundred cases of tuberculous meningitis and miliary tuberculosis treated with streptomycin, sulphones, and vitamins A and D.** Giorn. ital. di oftal. **1**:104-118, March-April, 1948.

Tabulation of the findings in one hundred cases of tuberculous meningitis and miliary tuberculosis leads the authors to the following conclusions. The ocular manifestations are of importance not because of the frequency of their appearance but their early onset. There were ophthalmoscopic manifestations in 68 percent, pupillary changes in 53 percent, extraocular disturbances in 29 percent of their patients. Of the disturbances of motility great importance is to be attached to the paralysis of conjugate movements, which is an expression of encephalic localization and constitutes a serious prognosis. Argyll Robertson pupil was encountered in 5.8 percent. All other pupillary changes are probably stages in the evolution of the Argyll Robertson pupil. Blurring of the papillary margins is ascribed to pressure in the nerve and intracranial cavity. It is always bilateral and therefore not a sign of a neuritis. This blurring may occur long before the papilledema. The presence of increased intracranial pressure is a manifestation of a meningeal process and not a result of the use of streptomycin. The presence of miliary choroidal lesions is an indication of generalized miliary tuberculosis and not of meningitis, which may, nevertheless, accompany it. Choroidal lesions were seen to disappear only in a few cases after the treatment of tuberculosis by the method of Cocchi (streptomycin, sulphones, vitamins A and D). It seems that miliary meningitis responds more favorably to this treatment since there is less tendency to exudation and infiltration. The blindness seen in 7.4 percent of the cases is ascribed to a central

lesion in the basal ganglia, occipital cortex, or optic pathways.

Francis P. Guida.

Schmidt, Rolf. **Eye changes in trichinosis.** Klin. Monatsbl. f. Augenh. **110**:73-79, Jan.-Feb., 1944.

In one group (19 persons) slight changes were noted after one meal, gastrointestinal disturbances and muscle pain in some, in six swelling of the lids, in two irritation of the conjunctiva. The eye changes disappeared after a few days. In a second group 60 persons exhibited severe eye symptoms after having eaten infested meat repeatedly. Fifteen died. In most there was pain, especially on movement of the eyes. Twice eye movements were limited and there was diplopia. Horizontal nystagmus occurred five times. In 55 cases recurrent lid edema, which is very characteristic of trichinosis, was noted; some patients were unable to open the eyes. The edema may spread to the face, especially the lips. The lid swelling is independent of the gravity of the disease. Irritation of the conjunctiva with photophobia was frequent. Subconjunctival hemorrhages occurred in ten patients and a few small retinal hemorrhages near the disc in 23. They disappeared without trace within two to four weeks but new hemorrhages occurred. They seemed to be of bad prognostic significance. In one patient a grayish-white retinal lesion probably due to embolism of a choroidal vessel with trichinae was seen. It disappeared without trace in three weeks. Histological examination of one eye showed that all the external muscles were infested with trichinae surrounded by dense infiltrates of lymphocytes and eosinophiles. George Brown.

Siqueira de Carvalho, J. **Ocular changes in sufferers from Hansen's disease (leprosy).** Rev. brasil. oftal. **6**:31-36, June 1948.

A general review, in Portuguese, of the manifestations of the disease in various parts of the visual apparatus. (References.) W. H. Crisp.

Toselli, C. **Note on the ocular lesions in congenital deafmutism.** Rassegna ital. d'ottal. **17**:258-263, July-Aug., 1948.

The author gives an interesting review of the ocular findings of other observers in deaf mutes. He then relates his observations on 230 individuals. The visual acuity, the defects of the muscular apparatus and the fundus changes are given in percentages. A discussion of the transmission, the etiology, and the pathologic basis of the degenerative lesions follows.

Eugene M. Blake.

Walker, V. B. **Allergic conditions of the eye: 2. Migraine.** Brit. J. Ophth. **32**:764-767, Oct., 1948.

Of 100 cases of migraine, 54 were proven to be on an allergic basis. In this allergic group desensitization or avoidance of the allergens gave relief from symptoms. In a study of the blood pressure between attacks it was found that the allergic patients had a noticeably lower systolic level than the nonallergic ones. The conclusion reached was that in patients with true migraine and low systolic blood pressure, allergy must be suspected. Orwyn H. Ellis.

19

CONGENITAL DEFORMITIES, HEREDITY

Alabastro, Augusta. **Hereditary transmission of retinitis pigmentosa with myoclonus epilepsy.** Riv. oto-neuro-oftal. **22**: 389-396, Sept.-Dec., 1947.

A genetic study of retinitis pigmentosa associated with myoclonus epilepsy is presented. In a family 102 members of six generations had retinitis pigmentosa and the lesion was associated with myoclonus

epilepsy in a mother and her three children. The mode of hereditary transmission of the combination of syndromes can only be hypothecated but a dominant heredity is most probable. It could be due to a factor that is pleiotropic in action and is different from factors which bring about the manifestation of the two different distinct forms separately. (1 table, references.) Melchiore Lombardo.

Arbenz, Jean. **Some new cases of Marfan's syndrome in Zürich.** Klin. Monatsbl. f. Augenh. **110**:216-229, March-April, 1944.

Nine patients with Marfan's syndrome are described. Several times an ectopia developed into a complete displacement. The tension was never increased. Surgery is contraindicated. One eye was practically lost due to loss of vitreous and detachment of the retina after operation. The transmission is as a rule recessive, exceptionally dominant.

George Brown.

Badtke G. **Ocular changes in arhinencephaly.** Arch. f. Ophth. **148**:490-514, 1948.

The author describes the two microphthalmic colobomatous eyes of an eight-months-old fetus. There were aplasia of the optic nerve, absence of nerve fibers in the retina although a few ganglion cells were present, absence of macula and fovea, folding and formation of rosettes of the retinal layers, aniridia, displacement of the remnants of the sphincter of the pupil, coloboma of the iris and ciliary body, cataract and persistence of the hyaloid artery.

Ernst Schmerl.

Ingalls, T. H. **Epidemiology of encephalo-ophthalmic dysplasia.** J.A.M.A. **138**:261-264, Sept. 25, 1948.

The relationship between this disease and prematurity is mentioned. Several factors are discussed which enter into the production of the condition, including the presence of the tunica vasculosa lentis in the eighth fetal month, the high rates for multiple births, toxemias of pregnancy, placental diseases, and hemorrhages among mothers of 41 babies who had the disease. An etiologic relation between antenatal hemorrhage of the mother and disease in the baby is indicated by the occurrence of most of the menorrhagias in the fifth, sixth, and seventh months of gestation. Sublethal anoxia is hypothecated as a principal agent in the production of the disease, because of the relationships to placenta previa, antepartum hemorrhage and eclampsia. (3 figures, 2 tables, discussion, references.) Bennett W. Muir.

Pickford, R. W. **Multiple allelomorphs in colour vision.** Nature **162**:684-686, Oct. 30, 1948.

The most convincing evidence for the theory that the statistically distinct forms of sex-linked red-green color vision defects are multiple allelomorphs might come from the study of their combinations. These combinations can occur only in women. In the present investigation 15 red-green defective women were tested and the significance of the data is elucidated. The hypothesis that there are six multiple allelomorphs for red-green color vision and its defects in man is supported by the fact that at least four and perhaps five different types of sex-linked red-green defects are statistically distinct. Many pedigrees indicate that these are inherited true to type or not at all and that these types segregate independently. Eight pedigrees show that the green anomalous condition is dominant to that of the deuteranope, while all the defective forms are recessive to normal red-green color vision. F. H. Haessler.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bahn, C. A. **What is new in ophthalmology.** New Orleans M. and S. J. **101**: 161-164, Oct., 1948.

Glaucoma is a most important disease for the ophthalmologist and early and efficient treatment is urged. Diisopropyl fluorophosphate, psychotherapy and surgery are discussed and their proper use is encouraged. Primary senile cataract is still treated only by surgery. The author mentions some of the aids used in surgery and the indications and advantages for intracapsular extraction. The use of contact glasses, corneal transplants and eye exercises are mentioned with the admonition that they be used sensibly and only when specifically indicated. The use of antibiotics is reviewed. The treatment of allergic reactions is discussed. The new anti-allergic drugs have given the patient some subjective relief but the structural appearance of the ocular tissues are not changed. The use of the Berman locater, the Filatov treatment of retinitis pigmentosa, the tracer isotopes, air injection into the anterior chamber, the use of rutin, the use of heparin and the use of X rays and radium are mentioned.

H. C. Weinberg.

Brown, E. V. L. **Edward Lorenzo Holmes: pioneer Chicago eye doctor.** Am. J. Ophth. **31**:1473-1475, Nov., 1948.

Carroll, A. M. **A challenge to all interested in medico-social and economical problems: industrial ophthalmology.** Bol. Asoc. med. de Puerto Rico **40**:186-189, July, 1948.

The author describes briefly the aims and practice of industrial ophthalmology in the United States and England. (37 references.) F. H. Haessler.

Fuchs, Adalbert. **On new types of ocular diseases.** Am. J. Ophth. **31**:1273-1280, Oct., 1948. (8 figures, 13 references.)

Godtfredsen, Erik. **Danish doctorate theses on ophthalmology through 112 years.** Acta ophth. **26**:89-106, 1948.

This is a survey and an analysis of 58 Danish ophthalmologic theses, published within a period of 112 years (1835-1945).

Ray K. Daily.

Jäger, A. **The retinal perspective.** Arch. f. Ophth. **148**:277-286, 1948.

It is known that the peripheral parts in the paintings of nearby objects do not always satisfy our esthetic feelings in spite of a geometrically correct perspective. Nearby objects are usually seen at a comparatively large visual angle. In this case the artist has to consider that the peripheral parts experience a barrel shaped distortion by the eye, probably due to the spherical shape of the retinal screen. The art of the ancient Greeks serves to illustrate these considerations.

Ernst Schmerl.

Mann, Ida. **Advances in ophthalmology.** Practitioner **161**:317-320, Oct., 1948.

Most of the original work during the war, limited as it was, of necessity was intimately connected with military matters and because of this had to remain secret. The war-time observations now appearing in the literature offer considerable that is both suggestive and new. General malnutrition and nutritional amblyopia were common during the war. The amblyopia is due to a small central or paracentral scotoma. There is a similarity to the retrobulbar neuritis that is found in disseminated sclerosis, but the nutritional type tends to produce permanent damage, uninfluenced by vitamins. B complex and probably a protein deficiency are concerned in the process. The knowledge of endocrine disease, par-

ticularly exophthalmos following thyroidectomy showed considerable advance. Now the role played by the various endocrine glands in this disease is much better understood and with this has come modification in the treatment as a result of greater accuracy in diagnosis. BAL and D. F. P. were two of the new drugs to come out of the war. The former was used locally to reverse the action of Lewisite. D. F. P., still on trial, was found to be a strong miotic. Progress has also been made with contact lenses and orthoptic treatment. Professor Amsler has by his new, safe technique of diagnostic puncture of the anterior chamber and microtechnique (culturing, microcentrifuging) for examining the material so obtained, supplied the greatest advance in the field of diagnosis. His work will aid the pathologist in attacking many obscure ocular problems.

In research, progress is noted along three paths. The first concerns itself with biological reactions. The better understanding of such reactions followed the studies made in chemical injury to the eye. Second in importance was the work of Stone on the transplantation and regeneration of eyes in amphibia. The use of the eye for experiments on wider pathological problems is the last of the three. Here, for example, experimental induction of tumors has been accomplished in the lens of animals with a high cancer incidence. Francis M. Crage.

Mirenburg, Bella. **The antitrachoma campaign in Jewish schools of Jerusalem.** Am. J. Ophth. **31**:1289-1292, Oct., 1948. (4 tables.)

Riise, Per. **The invalidity resulting from loss of one eye.** Acta ophth. **26**:237-240, 1948.

The regulations of the Norwegian State Insurance Board are criticized. Riise maintains that compensation for the loss of an eye should be based on two factors; the impaired earning ability, which is not significant, and insurance against more serious visual impairment through damage to the other eye. Ray K. Daily.

Rocco, Alfredo. **Historic aspects of the crystalline lens.** Arq. brasil. de oftal. **11**: 73-78, 1948.

The author presents a series of quotations from a manual of ocular maladies, published in 1840 at Rio de Janeiro, by João Antonio de Arzevedo. The quotations illustrate the conceptions of a century ago, in Brazil, regarding diseases of the crystalline lens. As to treatment, the choice is offered between extraction and couching of the cataract, although the author thought he had seen clearing of the lens, in the early stages of clouding, by various means including bleeding, drastic purgation, and the application of electricity to the back of the neck. The ideas of that day concerning ocular anatomy are briefly stated. W. H. Crisp.

Shaffer, T. E. **Study of vision testing procedures.** Am. J. Pub. Health **38**:1141-1146, Aug., 1948.

The purpose of this study was to evaluate several widely known screening methods for testing visual function, and to bring forth a future plan for a vision testing program. A total of 203 pupils from the first through the eleventh grades was studied using the Snellen Test for visual acuity, the Massachusetts Vision Test and the Keystone Telebinocular Test. At the same time ocular muscle functions were measured with prisms. The children were examined without and with cycloplegics. It was found in this stage of the investigation that the Snellen Test for visual acuity at 20 feet is the most reliable single screening procedure. Donald T. Hughson.

Stonehill, A. A. **A phantom for animal eye surgery.** Am. J. Ophth. **31**:1312, Oct., 1948. (3 figures.)

PAN-AMERICAN NOTES

Edited by MANUEL URIBE TRONCOSO, M.D.
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

FIRST NATIONAL CONGRESS OF OPHTHALMOLOGY IN MEXICO

This congress convened from January 9-15, 1949. Honorary presidents were: Dr. Manuel Uribe Troncoso, Dr. Manuel Marquez, Dr. Antonio F. Alonso, Dr. Ricardo Tapiz Ferandez, and Dr. Carlos Bauer; President, Dr. Lino Vergara Espino, 5 de Mayo No. 40-106, Mexico, D.F., vice-president, Dr. Rauel Arturo Chavira; general secretary, Dr. M. Puig Solanes, Av. Lopez Cotilla No. 811, Mexico, D.F.; treasurer, Dr. F. Palomino Dena; secretary of scientific activities, Dr. A. Torres Estrada; secretary of technical exhibits, Dr. M. Rivas Cherif; director of courses, Dr. Abelardo Zertuche.

The program included the following reports and free papers:

1. Sanchez Bulnes, Raymundo Figueroa, P. Cornejo, and A. Jimenez: "Statistical data on the refraction of the school children in the federal district of Mexico."
2. Daniel Silva and Narno Dorbecker: "Orbital angiographia."
3. M. Rivas Cherif: "Action of the horizontal muscles in the vertical vision: Its clinical interest."
4. Daniel Silva, Roberto Quiroz, and L. Rodriguez Caballero: "Exfoliation of the lens capsule."
5. Daniel Silva: "100 cases of keratoconus treated with contact lenses."
6. R. Olivera Lopez: "Surgical treatment of ocular cysticercus."
7. A Torres Estrada, R. Aguirre, F. Montellano, and Mario Salcedo: "Ocular tuberculosis and allergy."
8. Teodulo Agundis and J. Ursua Rincon: "Comparative study of corneal sutures and keratoplastics."
9. A. Torres Estrada and H. Rivero Borrell: "Considerations on the treatment of detachment of the retina."
10. Teodulo Agundis: "Therapeutic measures in strabismus."
11. A. Torres Estrada, M. Icaza, and E. Graue: "Therapeutic value of hemicyclodialysis in glaucoma."
12. T. Agundis and H. Sanchez Nuñez: "Ocular syndromes of extrapyramidal and divergence excess."
13. Lino Vergara Espino, Francisco Arenas, A. Ramirez, E. Camacho, J. L. Arce, J. Heatley, and Fernando Prieto: "Ocular accidents in industry."
14. J. Oropeza Barrios: "Refractometry in industrial workers."
15. A. Fonte B.: "Ocular changes in neurosyphilis (300 cases)."
16. A. Fonte B.: "Nuclear progressive ophthalmoplegia."
17. A. Fonte B.: "Vascular subcortical hemianopia."
18. A. Fonte B.: "A new syndrome in neuro-ophthalmology: The syndrome of the anterior pontine bulbar sulcus or of the artery of the blind foramen."
19. M. Puig Solanes: "Treatment of the vascular retinal occlusions with modern drugs."
20. M. Puig Solanes: "Comparative study of the vascular changes in the retina in essential hypertension and in nephrosis."
21. M. Puig Solanes and J. Canepa: "Retinal angioscopia in the hyperactors."
22. A. Zertuche and Oswaldo Arias: "Ocular manifestations in the disease of Nicholas Fabre."
23. F. Palomino Dena, S. Silva, and Victor M. Tapia: "The antibiotics in ophthalmology."
24. Luis Mazzotti: "Researches on the treatment of onchocercosis."
25. José A. Quiroz: "Retina pathology in diabetic patients."
26. Carlos Coqui: "Radiological studies of the orbit."
27. E. Mendoza Gonzalez and E. Avalos Gonzalez: "Etiology and pathogenesis of the scleral diseases."
28. J. Oropeza Barrios: "Biastigmatism in 1,500 ametropics."
29. J. Oropeza Barrios and A. Arroyo Damian: "Dacryocystectomy with nasal fistulization."
30. A. Arroyo Damian: "Considerations on hemorrhages in the anterior chamber."
31. J. Heatley, F. Arenas, R. Walletin, and Guerrero Ibarra: "Ocular changes in brucellosis."
32. A. Fonte B. and A. Ramirez: "Ocular motor disturbances in tumors of the brain."
33. M. Puig Solanes and A. Fonte B.: "Double hemianopia."
34. M. Puig Solanes: "Optochiasmatica arachnoiditis."
35. M. Puig Solanes and E. Garduño: "Surgery of the superior oblique."
36. R. Gonzalez Aguilar: "Heredity in ophthalmology."
37. Palomino Dena, R. Murillo, and Lucina Villegas: "Ocular manifestations of avitaminosis A."
38. F. Palomino Dena, R. Murillo, and Lucina Villegas: "Observations on retinoblastoma."
39. M. Uribe Troncoso: "Comparative physiology of the aqueous outflow in mammals and the role of Schlemm's canal."

Congress committee organized

Article 7 of the by-laws of the Pan-American Association of Ophthalmology says that within 60 days of the closing session of a congress the local organizing committee of the next congress shall be appointed. Professors of ophthalmology and representatives from the ophthalmic centers of the country shall comprise this committee. At a business meeting to which all members of the several ophthalmic societies in Mexico were invited, the following local committee was elected unanimously to organize the IV Pan-American Congress of Ophthalmology, scheduled to convene in Mexico City in January, 1952: Chairman, Dr. Antonio Torres Estrada; vice chairman, Dr. Magin Puig Solanes; general secretary, Dr. Luis Sánchez Bulnes; treasurer, Dr. Feliciano Palomino Dena; secretary of scientific activities, Dr. Raul A. Chavira; secretary for propaganda, Dr. Teófilo Agundis; secretary of surgical activities, Dr. Daniel Silva; secretary of social activities, Dr. Lino Vergara Espino; director of internal organization, Dr. Francisco Martinez; director of courses, Dr. Abelardo Zertuche; director of scientific exhibitions, Dr. Manuel de Rivas Cherif.

Meeting of the Board in Chicago, 1948

During a meeting of the executive officers of the Pan-American Association of Ophthalmology held in Chicago at the time of the meeting of the American Academy of Ophthalmology, it was decided to:

(a). Hold an interim meeting in New Orleans dealing chiefly with prevention of blindness and coinciding with the annual meeting of the National Society for the Prevention of Blindness.

(b). Send a mimeographed bulletin or news letter every month or every two months to all American ophthalmologists in order to arouse their interest in the association.

(c). Publish frequent editorials in the leading ophthalmic journals of America regarding the activities of the association. *Ophthalmologia ibero americana* will also publish editorials of the same nature.

(d). Hold instructional courses in Mexico City in 1952.

(e). Organize a scientific exhibition for the meeting in Mexico City in 1952.

(f). Invite the different ophthalmic societies throughout Latin America to select a subject and the person that should report on that subject and to nominate someone else to be the discussor of another paper. These papers, plus the papers from the different centers in the United States and Canada, would be the only official papers at the congress in Mexico.

(g). Have Dr. Oscar Horstmann and Dr. Frederick Cordes draft a plan for the establishment and assessment of ophthalmic societies in Latin America; this plan to be submitted to the executive committee for implementation.

(h). Create a committee on home study courses, the chairman of which is Dr. Horstmann, the members to be delegates to the council of the association. This committee will be responsible for the translation of the home study courses of the Academy and for the correction of the answers to the questionnaires sent in by the participants.

(i). Establish a committee for the standardization of tonometers, composed of Dr. Peter Kronfeld, Dr. A. B. Reese, and the delegates of the different countries. The two American members of this committee should write to the different delegates giving them the data on standardization of tonometers and suggesting that, where possible, local agencies for the standardization of tonometers should be established.

(j). Acquire all the teachers' manuals published by the Academy and have them duly translated into Portuguese or Spanish.

(k). Select Dr. William L. Benedict as the first vice-president of the Pan-American Association of Ophthalmology, as he is the senior vice-president.

(l). Suggest to the local committee in Mexico City that they should appoint one contact man from each delegation during the congress in 1952, whose job will be to report every day to the local committee on the feelings of his delegation, their grievances, their wishes, and so forth.

(m). Suggest to the Mexican local committee that, at the beginning of the meeting in Mexico City, they should organize a complete list of presidents of the different sessions during the convention.

(n). Establish a fellowship committee, the members of which would be: United States, Dr. Daniel Kirby, Dr. Frederick Cordes, Dr. John Dunnington, Dr. Alan Woods, Dr. Derrick Vail, Dr. E. B. Dunphy, Dr. Everett L. Goar, and Dr. Edward Carey. Canada, Dr. J. A. MacMillan and Dr. A. J. Elliott; Mexico, Dr. Antonio Torres Estrada, Dr. Magin Puig Solanes, and Dr. Luis Sanchez Bulnes; Argentina, Dr. Raul Argañaraz, Dr. Paulina Satanowsky, and Dr. Gunther von Grolman; Brazil; Prof. Ivo Correa Meyer, Prof. Hilton Rocha, and Prof. Paulo Filho; Bolivia, Prof. Aniceto Solares; Chile, Dr. Espildora Luque, Dr. Santiago Barrenechea, and Dr. Rene Contardo; Colombia, Dr. Alejandro Posada; Cuba, Dr. Horacio Ferrer and Dr. J. M. Penichet; Perú, Prof. Jorge Valdeavellano; Uruguay, Dr. Washington Isola and Dr. Alberto Vazquez Barriere; Venezuela, Dr. J. M. Espino.

Argentina

The Sociedad de Oftalmologia del Litoral has chosen the following officers to serve from August, 1948, to August, 1950: President, Dr. Juan Manuel Vila Ortiz; vice-president, Dr. Juan Maggi Zavalía; secretary, Dr. Máximo Carlos Soto; treasurer, Dr. Benito Bianco; members, Dr. Luis Woelflin, Dr. René Bazet, Dr. Mario Zurbriggen, and Dr. Juan P. Alliani.

An Argentine Society for Ophthalmic Research has been founded in Buenos Aires. The committee is: President, Dr. Flaminio Vidal; secretary, Dr. Jorge García Badaracco; treasurer, Dr. Aquiles J. Roncoroni; members, Dr. Alberto Agrest, Dr. J. Jouanchin, and Dr. Elida Serantes.

Brazil

It is with deep regret that we publish the news of the death of Prof. João Paulo da Cruz Britto, professor of ophthalmology of the Faculdade de Medicina de São Paulo and one of the best known ophthalmologists in Brazil. Born in 1880 in Caxias, J. Britto, after taking a course in humanities in Switzerland, went to England and was graduated from Oxford University. In 1901, he returned to Brazil and studied medicine at the Faculdade de Medicina do Rio de Janeiro. In 1910, he returned to Europe and worked for two years as voluntary assistant to Professor Fuchs in Vienna and later with Adams in Berlin. He returned to Brazil, in 1913, and started work in the Santa Luzia ward of the Charity Hospital. Three years later he was appointed professor of ophthalmology at the Faculdade de Medicina de São Paulo, a position which he occupied until his death.

Professor Bailliart

Returning from the Pan-American Congress of Ophthalmology held in Havana, Professor Bailliart, the French ophthalmologist, visited Rio de Janeiro on February 1, 1948. Professor Bailliart was the guest of the Sociedade Brasileira de Oftalmologia and was met at the airport by a committee from the society and by numerous ophthalmologists and friends. During his short stay in Rio, Professor Bailliart visited various places of interest, hospitals, and ophthalmic services. On February 2nd, he was received by the Sociedade Brasileira de Oftalmologia where he spoke on "Chronic Glaucoma." On the following day Professor Bailliart went to São Paulo, where he was received by the Sociedade de Oftalmologia de São Paulo.

Sociedade de Oftalmologia de São Paulo

At a meeting on April 14, 1948, Dr. A. Busacca presented a paper on "Elementary lesions of the cornea," and Dr. Paulo Braga Magalhães and Dr. Avelino Gomes da Silva read a paper on "Perforating injury of the cornea with a fish hook."

The following officers served during 1948: President, Dr. Durval Prado; Vice-President, Dr. Paulo Braga Magalhães; general secretary, Dr. Rubens Belfort Mattos; 1st secretary, Dr. Manoel Domingues de Castro; treasurer, Dr. Aureliano Fonseca; files, Dr. Roberto Reichert.

Sociedade Brasileria de Oftalmologia

At the June monthly meeting the following papers were presented: Dr. J. Siqueira de Carvalho: "The importance of ophthalmological examination when applying for work", and Dr. Natalicio de Farias: "New ophthalmic instruments."

At the July monthly meeting, Dr. J. Alves Ferreira read a paper on "Curare in a case of ocular surgery," and Dr. Evaldo Campos on "New and old theories on Daltonism."

V Jornadas Brasileiras de Oftalmologia

Meetings were held in Campinas from September 4-16, 1948. They were sponsored this year by the Associacão Medica do Instituto Penido Burnier.

Sociedade de Oftalmologia e Otorinolaringologia do Rio Grade do Sul

The following officers served during 1948: President, Dr. Ary A. Pinto; 1st secretary, Dr. Paulo Fernando Esteves; 2nd secretary, Dr. Aldo Foernges; treasurer, Dr. Ivo Adolpho Kuhl; librarian, Dr. Aldeir Esteves.

Nicaragua

Sociedad Nicaragiiense de Oftalmologia

On November 8, 1948, at Managua, Nicaragua, the Sociedad Nicaragiiense de Oftalmologia was founded and the following officers and members of the executive board were elected:

President, Dr. Victor M. Godoy; vice-president, Dr. Salvador Reyes; secretary, Dr. E. Alvarez Montalván; treasurer, Dr. Ricardo Lacayo G.; vice treasurer and 1st voting delegate, Dr. Adan Fuentes; 2nd voting delegate, Dr. Juan Derbishire; 3rd voting delegate, Dr. Ponciano Muñoz; delegate to the Pan-American council, Dr. Ricardo Lacayo G.

Among the principal objectives of the newly organized association is close cooperation with other ophthalmic societies and groups.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Hilmar George Martin, Chicago, died October 5, 1948, aged 55 years.

Dr. H. Brooks Smith, Bluffton, Indiana, died October 18, 1948, aged 40 years.

MISCELLANEOUS

CANDIDATES FOR BOARD EXAMINATIONS

The American Board of Ophthalmology wishes to make known that it does not evaluate, approve, or disapprove any ophthalmic residency as for filling the requirements for candidates for board examinations. Any candidate who qualifies for the board examination and completes the prerequisites as outlined in the syllabus will be accepted. A copy of the syllabus can be obtained from the secretary of the American Board of Ophthalmology, 56 Ivie Road, Cape Cottage, Maine.

ORTHOPTIC TECHNICIANS EXAMINATION

The annual examination of orthoptic technicians by the American Orthoptic Council will be conducted in September and October, 1949.

The written examination will be nonassembled and will take place on Thursday, September 8, 1949, in certain assigned cities and offices and will be proctored by designated ophthalmologists.

The oral and practical examinations will be on Saturday, October 8, 1949, in Chicago, just preceding the meeting of the American Academy of Ophthalmology and Otolaryngology.

Application for examination will be received by the office of the secretary of the American Orthoptic Council, Dr. Frank D. Costenbader, 1605 22nd Street, N. W., Washington 8, D.C., and must be accompanied by the examination fee of 25 dollars. Applications will not be accepted after July 1, 1949.

MEDICAL JOURNAL AWARD

Official announcement has been made by the *Illinois Medical Journal* that Dr. Kenneth L. Roper, Chicago, has been given the 200-dollar award for the best scientific article appearing in that publication during the 1947-48 fiscal year.

Dr. Roper's article, "Lancaster's technique of cataract extraction: Author's recent modifications with report of 125 consecutive cases," appeared in the February, 1948, issue of the *Illinois Medical Journal*.

The award is open only to members of the Illinois State Medical Society whose editorial board and *Journal* committee judge the articles that appear in the official publication of the society.

AWARDED REEVE PRIZE

The University of Toronto, Faculty of Medicine, has announced that Dr. J. C. McCulloch has been awarded the Reeve Prize. This award is made for the best scientific research accomplished in any department in the Faculty of Medicine by one who has held an appointment on the staff for not more than five years.

Dr. McCulloch was awarded this prize for his study in conjunction with Dr. R. J. P. McCulloch on "A hereditary and clinical study of choroideremia," which has added greatly to the knowledge of the previously obscure hereditary ocular condition. The disease was found in over 80 descendants of a family of 500 individuals who were studied.

Dr. J. C. McCulloch is ophthalmologist-in-chief at Toronto Western Hospital and was recently appointed associate, Department of Ophthalmology, in the University of Toronto.

SOCIETIES

WASHINGTON SPEAKER

Dr. Frank B. Walsh of Baltimore, Maryland, spoke on "Abnormalities of the optic disc: Their importance in diagnosis," at the January 3rd meeting of the Washington, D.C., Ophthalmological Society.

BROOKLYN PROGRAM

During the instruction session of the 160th regular meeting of the Brooklyn Ophthalmological Society on December 16, 1948, Dr. Harold W. Brown discussed "Clinical aids in the diagnosis of strabismus." Papers for the evening were given by Dr. Raymond L. Pfeiffer on "Dermoids and epidermoids of the orbit," and Dr. John H. Bailey on "Metastatic adenocarcinoma of the choroid."

READING CHRISTMAS PARTY

The Reading Eye, Ear, Nose, and Throat Society held its annual Christmas dinner-dance at the Wyomissing Club on December 8, 1948. It was attended by 108 persons.

PITTSBURG GUEST SPEAKER

Dr. Richard G. Scobee, director of graduate training in ophthalmology, Washington University, Saint Louis, was the guest speaker at a recent meeting of the Pittsburg Ophthalmological Society. The subject of his address was "Important aspects of the recession operations."

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Ophthalmologica

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Journal international d'Ophtalmologie
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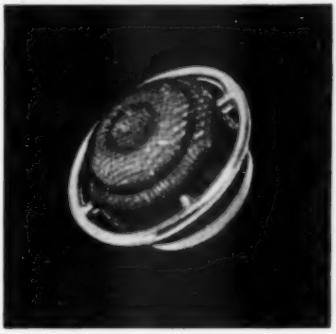

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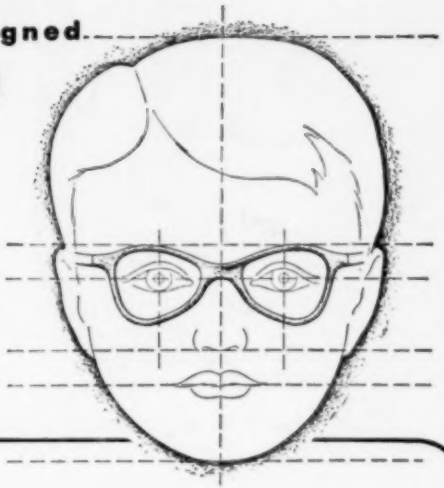

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38 mm.	16 mm.	54 mm.	On Plane
40 mm.	14 mm.	54 mm.	On Plane
40 mm.	14 mm.	54 mm.	Outset
40 mm.	16 mm.	56 mm.	On Plane
40 mm.	16 mm.	56 mm.	Outset

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